EXPANDED SITE INVESTIGATION

REMEDIAL OVERSIGHT OF ACTIVITIES AT FORT DEVENS PLOW SHOP POND AND GROVE POND

FINAL

May 2006

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Submitted to:
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Region 1
Boston, Massachusetts

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GROVE POND AND PLOW SHOP POND
AYER, MASSACHUSETTS

May 2006

Prepared for :

USEPA Region 1
Contract EP-W-05-020 Task Order #01

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1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) directed Gannett Fleming, Inc. (Gannett Fleming) to conduct an Expanded Site Investigation (ESI) and prepare an ESI Report for Plow Shop and Grove Ponds that are adjacent to the former Fort Devens National Priorities List (NPL) site. The objective of this investigation is to prepare an ESI report, using the sediment, soils, surface water, biota, benthic invertebrates, fish, frog tissue, swallow tissue, and toxicity data collected to date, to support the selection of an approach for site remediation. This report is in response to the approved Task Order Number #01 under Contract Number EP-W-05-020.

The former Fort Devens is located at the intersection of four towns: Ayer, Harvard, Lancaster, and Shirley in Middlesex and Worcester counties, Massachusetts. It is located 40 miles west of Boston. Fort Devens was listed on the NPL in November of 1989. In 1991, it was identified for cessation of operations, pursuant to the Base Realignment and Closure of 1991, commonly known as BRAC II and was officially closed in September 1996. Portions of the property formerly occupied by Fort Devens were retained by the Army for reserve forces training and renamed the Devens Reserve Forces Training Area (RFTA). Areas not retained as part of the Devens RFTA were, or are in the process of being, transferred to new owners for reuse and redevelopment.

Plow Shop and Grove Ponds are located at the southern border of the business and residential district in Ayer. The pond basins are bounded on the west and south by former Fort Devens property, to the northeast by residential areas, and to the southeast by land controlled by the Town of Ayer and used as a municipal well field. They are the fifth and sixth in a chain of six ponds in Ayer.

Sediment data collected from the two ponds through the 1990s indicate that elevated levels of several trace elements including arsenic, cadmium, chromium, mercury, and lead may be present at concentrations that pose significant human health and ecological risks. In October 1995, the Army issued a report that summarized all of the information collected to date and performed a Preliminary Risk Evaluation (PRE) in order to qualitatively gauge what risk the ponds were posing to human health and the environment. Primary concerns focused on the impacts from the ponds on Town and Devens drinking water supplies, fish and wildlife resources, and recreational activities such as fishing, hunting, and swimming. The PRE determined that exposure to both Plow Shop and Grove Pond sediments presented both human health and ecological risks. Both ponds were subsequently posted “Catch and Release Fishing Only.”

In the late 1990s, EPA, in cooperation with the U.S. Fish and Wildlife, the U.S. Geological Service and the MADEP, embarked upon an effort to collect the necessary information to address the data gaps identified in the Army’s 1995 report. The data collected from the joint effort were used when preparing this ESI Report for both Grove and Plow Shop Ponds.

1.1 Report Organization

This report consists of eight sections. In Section 1.0, the Introduction defines the purpose and study objectives of the ESI. Section 2.0 provides a general description of Grove Pond and Plow Shop Pond, including site history and background information. Within Section 3.0 is an evaluation of the existing data and includes references to previous studies and investigations; a summary of the analytical data is presented; and background studies are identified. In Section 4.0, a brief description of the physical characteristics of the study area is provided including the local geology, local meteorological conditions, and a general description of the surface water and groundwater hydrology. Section 5.0, presents conceptual models and supporting information for the presence of the principal chemicals of potential concern in sediment in Grove and Plow Shop Ponds. This section includes a discussion of the rationale for the concentration, distribution, plausible source(s), and transport mechanism(s) for each element of interest. The emphasis of this section is on elements and/or compounds that have been identified in previous studies of the ponds or in the present effort as potentially significant from a risk perspective. In Section 6.0 is the Human Health Risk Assessment, which evaluates whether site contaminants pose a current or potential risk to human health and the environment. In Section 7.0 is the Ecological Risk Assessment, which evaluates and assesses the risk to the environment posed by site contaminants. Lastly, Section 8.0 provides a summary of the conclusions.

2.0 SITE BACKGROUND

For the Grove and Plow Shop Ponds ESI, the "study area" or "the site" refers to Grove Pond and Plow Shop Pond, located in the Town of Ayer, Middlesex County, Massachusetts. Refer to Figure 2-1 – Site Location Map for the approximate boundaries of the ponds. The study area is located approximately 35 miles northwest of Boston.

2.1 Site Description

The study area is located northeast of the former Fort Devens, currently referred to as Devens. Grove and Plow Shop Ponds are included in a string of six ponds. Grove and Plow Shop Ponds are the most downgradient of the six ponds and, Plow Shop Pond drains into Nonacoicus Brook. In the downgradient direction, the string of ponds are referred to as: Long Pond, Sandy Pond, Flannagan Pond, Balch Pond, Grove Pond, and Plow Shop Pond. These ponds were formed by a series of dams installed in the 19th century. During that time Grove and Plow Shop Ponds were periodically "flowed" or flooded during the winter months to provide a source of ice and were drained during the spring and summer for grazing of livestock. Prior to the existence of the ponds, the area that is now submerged was occupied by meadows underlain by peat bogs.

Grove Pond is roughly triangular in shape and covers about 60 acres. The northern shore includes the location of the Plastic Distributing Company (PDC, location of former tannery operations), Pirone Park owned by the Town of Ayer, and residential properties. The southeastern shore is bordered by property owned by the Town of Ayer. The southern shore is also bordered by property owned by Fort Devens. Within this area are Devens' water supply wells, which are currently active with treatment**.** Immediately beyond the Devens' shoreline is the Massachusetts National Guard. The western edge of the pond is formed by the railroad causeway, owned and operated by Guildford Transportation (formerly Boston & Maine Railroad, B&MRR).

Grove Pond is shallow, with maximum water depth approximately 5 to 6 feet, and the water is frequently eutrophic, or well nourished by aquatic plant life. The pond bottom consists largely of a thick mat of decomposing vegetation. Grove Pond receives drainage from Balch Pond, as well as from Cold Spring Brook and Bowers Brook, and discharges through a culvert on the western edge of the pond into Plow Shop Pond. Cold Spring Brook is downgradient of Devens. Bowers Brook connects into Cold Spring.

Town of Ayer Well Field: The Town of Ayer wells are located on south shore of Grove Pond off Barnum Road, immediately outside the Devens Barnum Gate. These two wells were installed several decades ago by the Town of Ayer originally as backup to the Town's Spectacle Pond well field. The first of these wells, Grove Pond No. 1, was installed in 1943. It is 60 ft deep, with a rated capacity of 694 gpm. The second, Grove Pond No. 2, was constructed in 1952. It is 60.5 ft deep, with a rated capacity 780 gpm, and is located 120 ft west of the first well. Both are within

150 ft of Grove Pond. The original, hand-sketched construction diagrams for these wells, as well as the drillers' log for Grove Pond No. 2, are reproduced in Appendix A of the 1999 Phase I Interim Data Report (Gannett Fleming, 1999). In 1998, after rehabbing and construction of a water treatment plant at the site, these wells were added to Town of Ayer's distribution system.

Devens Grove Pond Well Field: The Devens Grove Pond well field is located approximately 1,000 feet to the west of the Town of Ayer wells. The general hydrogeologic setting of this well field is similar to the Town of Ayer wells, i.e., the wells are screened in the overburden aquifer in proximity to Grove Pond. These 12 wells have 8-inch diameter casings and 10 ft screens centered at depths of 35 ft to 43 ft below ground surface (bgs). The wells have been pumped at relatively low rates since activities on the Base decreased in recent years (e.g., 550--680 gpm total production for several days per month, in 1998).

Plow Shop Pond is also a shallow pond and is approximately 30 acres. The central portion of the pond is approximately 8 feet deep, and the deepest portion of the pond is reported to be at the northeast arm of the pond. The water level is controlled by a dam located at the northwest corner of the pond where it forms Nonacoicus Brook and its associated wetlands, which in turn flows approximately 1.5 miles northwest into the Nashua River. Plow Shop Pond is similar to Grove Pond in regards to the aquatic community; however, Plow Shop Pond is smaller and slightly deeper, and the aquatic vegetation tends to be less dense than Grove Pond. (USFWS, September 2000)

The northern shore of Plow Shop Pond is bordered by commercial businesses. The eastern shore is the Guilford Transportation railroad causeway. The southern and western shores include the former railroad roundhouse, and woodland and grassland associated with Shepley's Hill Landfill. Both ponds are used by local residents for recreational fishing. Signs are posted for "catch and release" fishing.

In 1998, the U.S. Geological Survey (USGS) used a high-frequency acoustic energy fathometer and ground-penetrating radar (GPR) to measure water depth and saturated sediment thickness at more than 1000 locations in Grove Pond and Plow Shop Pond (Mercadante et al., 1999). Ground-truth values were obtained manually at several locations by pushing a stick into the sediment until refusal was met. Results from Grove Pond show a maximum water depth of 1.93 meters, in the northwest end of the pond. Sediment thickness is generally uniform over much of the pond bottom, ranging from 0.5 m around the pond's perimeter to about 2.5 m in spots along the pond's central axis. In Plow Shop Pond, the maximum water depth, 2.43 m, occurs at the north end of the northeast arm of the pond. Sediments in Plow Shop Pond are thicker than in Grove Pond. Sediment thickness over most of the western half of the pond is approximately 5 to 5.5 m in places and may have been emplaced prior to the construction of the dam in 1887 (Mercadante et al., 1999). On the eastern side of Plow Shop Pond, sediment thickness is somewhat more uniform, ranging from 0.5 m along the shore to about 4 m at a distance of approximately 100 m offshore (toward the center of the pond).

2.2 Site History

Gannett Fleming reviewed an aerial photograph from 2001, Sanborn Maps for the years 1892, 1921 and 1949, and various reports to understand the general history of the ponds and land uses adjacent to the ponds and brook in regards to potential sources of contaminants to the study area. Refer to Appendix A for the Sanborn Map Review, which includes property descriptions from 1892 to 1949.

Grove Pond

A tannery, located on the northwest corner of Grove Pond, operated intermittently from 1854 through June 1961 until a fire destroyed the operation. Prior to 1953, tannery wastes were discharged directly into Grove Pond with little or no treatment. In addition to tannery operations, a landfill was formerly located between the tannery and Grove Pond. Its location is suggested by aerial photographs that show gradual infilling of a cove in the northwest corner of Grove Pond.

According to the Sanborn Map Review, north of the tannery is the location of a former foundry and machine shop. These types of operations are documented as early as 1887, and operations ceased some time between 1921 and 1949. The 1949 Sanborn Map indicated that the property was used by a rope storage company and for paper and pulp storage. This area is the current location of the Faulkner Drive site as shown on Figure 2 –1 Site Location Map.

East of the former tannery, is Pirone Park, where landfilling may have occurred in the past. According to the Environmental FirstSearch™ database for the study area, a solid waste landfill is present at Pirone Park and is identified as the Town of Ayer Demolition Landfill. Refer to Appendix C of the May 2002 Gannett Fleming Data Gap Evaluation Report (Gannett Fleming, 2002a) for the results of the database search. Based on electronic correspondence with the MADEP, this "location was never a sited landfill, but is a piece of municipally owned property adjacent to Pirone Park. The Ayer DPW used the property as a dumping ground for pieces of asphalt and concrete, etc."…"It's badly overgrown with odd piles of asphalt and concrete the above interspersed among heavy vegetation. This site was never a municipal solid waste landfill nor a demo landfill."

Other potential sources of contamination to the pond are: stormwater runoff from the Guildford Transportation (former B&MRR) railroad yard and causeway on the southern/western shore; historical infilling of portions of the pond's perimeter; inflow from Cold Spring Brook and Balch Pond; and runoff from Devens and the Town of Ayer. Extensive apple orchards lie within the drainage basin for the pond, and historical application of arsenic-containing pesticides was suggested as a potential contaminant source. The contribution of arsenic and other metals to pond-bottom sediments by discharging groundwater may be significant.

Plow Shop Pond

Plow Shop Pond is bordered to the north by commercial properties. Sanborn records indicate that a lumber company, northwest of the pond, had been in operation since 1887 and at least until 1949.

Other potential sources of contamination to the pond are: stormwater runoff from the Guildford Transportation (former B&MRR) railroad and the former Railroad Roundhouse; historical infilling of portions of the pond's perimeter; and, Shepley's Hill Landfill.

Elevated concentrations of arsenic (greater than the current MCL of 10 µg/L) have been reported from groundwater in the vicinity of Grove Pond (Gannett Fleming, 2002) and Plow Shop Pond (e.g., from numerous monitoring wells and direct-push sampling in the vicinity of Shepley's Hill Landfill). While groundwater was not included in the list of media to be evaluated for this report, mechanisms responsible for trace-element mobilization have been described qualitatively in discussions of the Conceptual Site Models (CSM) as appropriate. For example, in Sec. 5.3.3 the CSM proposed for arsenic suggests that this element may be accumulating in pond sediments due to precipitation at a redox boundary below the sediment-water interface. Reducing groundwater, enriched in dissolved arsenic, iron, and other trace metals, migrates upward and encounters more oxidizing conditions before discharging to the pond. As geochemical conditions evolve along this flow path, to a point where pH and ORP favor oxidation of iron its precipitation as a solid, ferric oxyhydroxide. Other trace elements, including arsenic, are sorbed by this phase.

A detailed discussion of groundwater hydrologic conditions for Grove Pond and Plow Shop Pond is provided in Section 5.10. In this discussion, mass flux calculations are presented for arsenic, iron, and manganese in sediments in Red Cove. The agreement between the mass estimated from groundwater data for these elements, and the observed average sediment concentrations, supports the general CSM.

3.0 EVALUATION OF EXISTING DATA

3.1 Previous Studies

Gannett Fleming acquired documents pertaining to investigations of the study area and surrounding properties from several sources. The majority of the reports were received from the BRAC library located at Devens. Other sources to obtaining studies included the MADEP Central Regional office and the Town of Ayer public library. A large number of documents were acquired and are maintained in the Gannett Fleming library in Newton, Massachusetts. A listing of the documents from which data were taken for use in the ESI with brief descriptions is included in Appendix A. Following this list are key data tables used in this ESI Report.

As part of the Data Gap Evaluation prior to this ESI, Gannett Fleming summarized each document, describing the different investigations and analyses performed. The summaries indicated if laboratory reports or quality assurance/quality control (QA/QC) information was included in the document. These summaries were used to assist in determining which analytical data to enter into the Geographical Information System (GIS) database.

3.2 Summary of Analytical Data

Analytical data from nearly half of the reports obtained were used in the GIS database. The reasoning for not utilizing reports for data input was:

- The report did not include analytical data.
- More recent studies included the data from previous studies.
- The sample locations were unknown.
- Some reports were draft reports and finalized report information was used.
- Remediation activities took place and confirmatory samples indicated a change in contaminant levels.

3.2.1 Development of Database Management System

Gannett Fleming utilized GISKey™ software as the database management system for the analytical data used in this ESI Report. The GISKey database interfaces with AutoCAD®, where figures have been produced to aid in visually understanding and evaluating contaminant distribution. Sample locations are identified in Figure 3-1 and Figure 3-2 for Grove Pond and Plow Shop Pond, respectively. All contaminant information on the figures is included in the analytical summary tables. The analytical summary tables are organized by pond, medium, and depth and are included as Appendix B.

3.2.2 Analytical Data

As part of the Data Gap Evaluation, the chemistry data were compared to EPA Region 9 Preliminary Remediation Goals (PRGs) for the human health risk screening. For the ecological risk screening, analytical data were compared to US EPA National Ambient Water Quality Critera, Oak Ridge National Laboratory (ORNL) Secondary Chronic Values, Ontario Ministry of the Environment (OME) benchmarks, and National Oceanic and Atmospheric Administration (NOAA) standards, where applicable. These benchmarks were employed to add a risk perspective to an initial evaluation of the nature and extent of contamination in the ponds.

The majority of the reports used for database input did not include laboratory analytical reports. Where analytical reports were not available, summary tables found within the reports were used. In some cases, it appears that contaminant concentrations from summary tables may represent laboratory method detection limits; however, if there were no notes in the summary tables indicating detection limits, the concentration was entered into the database.

Most of the investigations focused on inorganics, which is appropriate for the historical and current site use around the ponds. However, in some cases, such as the Railroad Roundhouse, the emphasis included organics appropriate for the likely source of contamination.

Below is a summary of the environmental media reviewed for this ESI Report. Based on field observations (odors, sheen, *etc.*) recorded during EPA's 2004-2005 field programs, VOCs, SVOCs, and PAHs should be evaluated in the subsurface sediments and groundwater in the Red Cove and RRRH areas.

Sediment, < 1 foot below grade

For inorganics, primarily aluminum, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, sodium and zinc were in exceedance of the benchmarks identified above. In very few cases, all inorganics analyzed exceed the benchmarks. Pesticide analysis primarily included 4,4'-DDD, 4,4'-DDE and 4,4'-DDT and/or endrin with the exception of sediment samples SED-A through SED-G (October 1992), Sediment 1 through Sediment 6 (April 1994), and SW-2 through SW-4 (December 1993) collected from Grove Pond, which included full analyses of pesticides. Heptachlor was analyzed in some Plow Shop Pond sediment samples, and there were no exceedances. Pesticide exceedances occurred in the southwestern portion of Grove Pond, and along the Plow Shop Pond shoreline abutting the railroad causeway, the Railroad Roundhouse, and the west/southwest shoreline near Shepley's Hill Landfill.

PCBs were analyzed in Grove Pond sediments SED-A through SED-G, Sediment 1 through Sediment 6, and SW-2 through SW-4; and, nothing was detected.

VOCs were analyzed in sediment samples collected near the Railroad Roundhouse and in Grove Pond sediments SED-A through SED-G, Sediment 1 through Sediment 6, and SW-2 through SW-4; and, there were no exceedances. Acetone, methyl ethyl ketone and methylene chloride was analyzed for in sediment samples in Plow Shop Pond downgradient of SHL; and, there were no exceedances.

SVOCs were analyzed in sediment samples collected from Grove Pond and Plow Shop Pond. In Grove Pond, exceedances (anthracene, fluoranthene, fluorene, hexachlorobenzene, 2-methylnapthanlene, napthalene, phenanthrene and/ or pyrene) occurred in sediment samples GRD-95-08X, -09X, -14X, -15X, -26X, -27X, -29X, -31X, -33X, -36X, and -50X. For Plow Shop Pond, SVOC exceedances occurred in SESHL11 (pyrene) and SESHL 12 (benzoanthracene, chrysene, napthalene, phenanthrene and pyrene).

Other analyses for sediments included residue, hydrogen ion, and total organic carbon (TOC).

Surface Soil, < 1 foot below grade

Surface soil samples were collected at Faulkner Drive, PDC, along the shoreline of Grove Pond, and along the shoreline of Plow Shop Pond in the area of the railroad causeway and the Railroad Roundhouse. Surface soil samples were compared only to residential PRGs.

For Faulkner Drive, the samples were analyzed for metals, pesticides and PCBs, VOCs, and SVOCs. The metals with the most frequent exceedances were arsenic, antimony, and lead. However, there were some samples with exceedances for cadmium, chromium, mercury, manganese, nickel, and zinc. There were no exceedances for samples that were analyzed for pesticides, PCBs, or VOCs. There were exceedances of SVOCs; however, some of the exceedances appear to be method detection limits.

For PDC, surface soil samples were analyzed for metals only. Exceedances were found for aluminum, antimony, arsenic, chromium, iron, lead, mercury, methyl mercury, nickel, and zinc.

For samples collected along the Grove Pond and Plow Shop shoreline, exceedances are similar to what was found in sediments.

Deep Sediment and Subsurface Soil, > 1 foot below grade

Metals were analyzed in subsurface soil at Faulkner Drive, PDC, and the railroad causeway, and in 2 samples from Shepley's Hill Landfill. Metals were analyzed in deeper sediment/subsurface soil in Grove and Plow Shop Ponds. For Faulkner Drive, PDC, the railroad causeway, SHL, Grove and Plow Shop Pond, exceedances occurred primarily for arsenic, cadmium, chromium, lead, and mercury. However, exceedances also occurred for antimony, iron, magnesium, and zinc.

Pesticide analysis primarily included 4,4'-DDD, 4,4'-DDE and 4,4'-DDT collected from Plow Shop Pond samples. Full pesticide analysis was performed on soil samples collected from PDC. Endrin was analyzed in samples collected from Grove Pond. There were no pesticide exceedances.

PCBs were only analyzed for soil samples collected from PDC; and, there were no exceedances.

Trichlorofluoromethane was the only VOC analysis performed for soil/sediment deeper than 1 foot below grade. These samples were collected from deep sediments in Plow Shop Pond; and, there were no exceedances.

SVOCs were analyzed at PDC, Grove Pond near the tannery, Railroad Roundhouse, and Faulkner Drive. In Grove Pond, near the former tannery, benzo (a) pyrene exceeded the benchmark. Napthalene was identified as an exceedance at PDC. At the Railroad Roundhouse at various depths, various SVOCs were identified. Faulkner Drive had SVOC exceedances. There were no SVOC analyses for deep sediment or subsurface soil at Plow Shop Pond.

Surface Water

Gannett Fleming did not enter surface water analytical data from all reports obtained. Gannett Fleming reviewed the reports and entered data from Grove Pond (1992, 1995, 1998, 1999, and 2000) and Plow Shop Pond (1991, 1993, 1995, and 1998). Gannett Fleming also included surface water data from the EPA sampling effort in 2004. Analyses included total metals, dissolved metals, pesticides and PCBs, VOCs, and SVOCs.

Total metals exceedances were found in both Grove Pond and Plow Shop Pond. For Grove Pond, exceedances included arsenic, chromium, manganese, and iron. For Plow Shop Pond, exceedances from samples collected in 1991 included arsenic; however, in 1995 exceedances included aluminum, antimony, arsenic, chromium, iron, manganese, mercury and vanadium. (Note: the metal analysis for PSP in 1995 included a broader range of metals.)

Dissolved metal analysis was performed on surface water samples collected from Grove Pond and Plow Shop Pond. For Grove Pond surface water samples, exceedances included antimony, chromium, cadmium, manganese, and thallium. For Plow Shop Pond, four surface waters samples were collected in 1993 and one exceedance occurred for dissolved arsenic and manganese.

PCBs were only analyzed in surface water samples collected from Grove Pond; and, there were no exceedances.

Pesticides were analyzed in surface water samples collected from Grove Pond and Plow Shop Pond. There were no exceedances in the samples collected from Grove Pond. For samples collected from Plow Shop Pond, alpha-BHC and endrin were reported in the analyses. Endrin exceedances occurred in surface water collected from Plow Shop Pond.

VOCs were analyzed in surface water samples collected from Grove Pond and Plow Shop Pond. In 1993, surface water samples were collected from Grove Pond, and there were no exceedances. In 1995, six surface water samples collected from Grove Pond were reported to be analyzed for BEHP, five of the samples exceeded the PRG. In 1991, 14 surface water samples were collected from Plow Shop Pond; and, cis-1,2-dichloroethylene, methylene chloride, and chloroform were in exceedance of the PRGs.

SVOC analyses were performed on surface water samples collected from Grove Pond, and there were no exceedances.

Other analyses for surface water included: residue, TOC, inorganic analyses (non-metallic, i.e. alkalinity, chloride, nitrate), hardness, and hydrogen ion.

Groundwater

Groundwater data were not used in the risk assessments but were used to support the conceptual site model (CSM) and aid in background evaluations. Gannett Fleming did not enter groundwater analytical data from all reports obtained. We reviewed the reports and entered data that showed historical sampling events for SHL from 1991 through 2001. Data were entered from sampling events at PDC for August and November 1999. Samples were also entered into the database from Faulkner Drive (2000) and the railroad causeway (1993). Analysis included total metals at PDC and SHL; dissolved metals at Faulkner Drive and the railroad causeway; pesticide and PCB analysis at the railroad causeway; VOCs at Faulkner Drive, PDC, the railroad causeway, and SHL; and SVOCs were analyzed for at Faulkner Drive and the railroad causeway.

Total metals exceedances were discovered in groundwater collected from wells at PDC for arsenic, chromium, and mercury. For samples collected in association with Shepley's Hill Landfill, primarily the groundwater analysis included only arsenic and exceedances occurred in the majority of groundwater samples collected for arsenic analysis. However, there were samples collected from Shepley's Hill Landfill for a broader range of total metal analysis. Exceedances included primarily arsenic, chromium, iron, and manganese. There were some exceedances for thallium and vanadium.

Dissolved metal exceedanaces did not occur in groundwater samples collected from wells at Faulkner Drive; however, the summary tables reviewed in the reports are not detailed. The railroad causeway analysis was more complete; and, exceedances occurred primarily for manganese, with an exception of one sample (ERM-8) with groundwater exceedances for arsenic, iron, and manganese.

Pesticides and PCB analysis performed for groundwater samples collected from wells at the railroad causeway did not have groundwater exceedances.

VOCs were analyzed in groundwater collected from wells at Faulkner Drive; however, only 1,1,1-trichloroethane and 1,2,4-trimethyl benzene were reported, with 1,2,4-trimethyl benzene exceeding the benchmark in groundwater from 6 wells in February 2000. Groundwater samples collected from the railroad causeway were analyzed and reported for a broad range of VOCs; and, there were no exceedances. Groundwater samples collected from PDC were also analyzed and reported for a broad range of VOCs; and, there was one exceedance for 1,2,4-trimethyl benzene, one (1) exceedance for methyl tert-butyl ether (MBTE), and two exceedances for naphthalene. For Shepley's Hill Landfill, groundwater was collected for analyses of a select list of VOC contaminants: 1,1-dichloroethane, 1,2-dichloroethane, 1,2-dichloroethene, acetone, benzene, m-dichlorobenze, methyl isobutyl ketone, MBTE, o-dichlorobenze, p-dichlorobenzene, sec-butylbenzene, and xylene. Exceedances occurred at Shepley's Hill Landfill for benzene (3 exceedances in June 1999, 1 exceedance in November 1999, and 4 exceedances in May 2001); and p-dichlorobenzene (1 exceedance in May 2001).

SVOCs were analyzed in groundwater collected from 6 wells located at Faulkner Drive and 8 wells located at or near the railroad causeway. For Faulkner Drive, groundwater was collected and reported for a select list of SVOC contaminants: 1-methyl naphthalene, acenapthene, acenaphthylene, anthracene, fluoranthene, fluorine, naphthalene, phenanthracene, and pyrene. In 2000, two rounds of samples were collected; and, in total, there was one (1) exceedance for 1-methyl naphthalene and 6 exceedances for naphthalene. For the railroad causeway, in 1993 a full SVOC analysis was performed and there were no exceedances.

Biological Tissue Data

Several reports provided data for biological tissues. These were incorporated into the human health and ecological risk assessments. Chemical analyses were conducted for fish, frog, and invertebrate tissue, as well as tree swallow eggs and stomach contents. In addition, data from surface water and sediment toxicity tests were used in the ecological risk assessments. Please, refer to the human health and ecological risk assessments for a list of data sources and summaries of the data used for each assessment.

3.2.3 Validation Review

A validation review of the quality of the analytical data from the various investigations was conducted as part of the Data Gap Evaluation leading up to the ESI Report. The data that were determined to be usable in the ESI were used for site characterization, conceptual model development, and human health and ecological risk assessments.

Many reports were used to assemble the analytical database. These reports were reviewed to determine and evaluate:

1. The level of data validation or review performed at the time the data were generated,
2. The analytical protocols and laboratories utilized, and
3. The availability of Quality Assurance (QA) and Quality Control (QC) information.

The review conducted was similar to an EPA Region 1 Tier 1 data validation (EPA, 1996) review in that one of the goals was to determine whether there was enough information provided to conduct a higher level of data validation, if desired. The analytical data were generated over a period of 13 to 14 years, by various laboratories, and for many different reasons and entities. The documentation available for each of the data sets is as varied as the sources. It should be noted that none of the data appear to have undergone formal data validation as per EPA data validation guidelines (EPA, 1996).

In order to be able to justify combining any of these data sets in the future, minimum usability criteria were implemented to complete this review. Data were determined to be usable for ESI purposes under the following conditions:

1. EPA-approved or equivalent laboratory methods were used,
2. Data were generated by an EPA laboratory or under the Army Corp of Engineers analytical and review protocols,
3. Enough QA/QC information was provided in the report to perform a Tier II level data validation at some future time, or
4. EPA had already reviewed and accepted the data.

If none of the above conditions were met, the data set was assigned a “Not Acceptable” data usability code. These data were not used in the ESI.

As demonstrated in these tables, the vast majority of the data were determined to be usable based on the minimum usability criteria. For example, the human health risk assessment will not utilize data from samples that were field filtered or collected to support ecological studies. These types of use limitations will be identified in task-specific sections.

In addition, it may not be appropriate to combine data generated using different analytical methods for some purposes. For example, the metals data in the Haines (2001) report were generated using non-standard analytical methods. It may not be appropriate, in all cases, to combine those metals data with other metals data due to differences in the detection limits and other specifics of the methodologies.

4.0 SITE CHARACTERISTICS

4.1 Geology

There are bedrock outcrops in some locations within the Fort Devens reservation, and in other areas bedrock is buried by glacial deposits to depths of 200 feet or more. Primary post-glacial deposits are peaty swamp deposits found mostly along streams, surface water bodies; and artificial fill. Depth to bedrock beneath Grove Pond has not been verified; however, results of a seismic refraction survey close to Grove Pond indicate a layer that is believed to be consolidated till and/or bedrock at depths of 60 to 100 feet below grade. Unconsolidated, surficial material in the area consists of stratified glacial outwash (kame plain and kame terrace) deposits, primarily coarse sand and gravel. Logs from borings advanced along the south side of Grove Pond, close to the Town of Ayer wells, report fine to coarse brown sands and angular gravel. A gray silty layer, approximately 10 feet thick, was encountered at a depth of about 35 - 45 feet below grade in one well at the edge of Grove Pond (well 92-3; CDM, 1993). The lateral extent of this layer is unknown, although it has been inferred to be continuous beneath the pond based on the response of well 92-3 in the pump tests (CDM, 1993).

Bedrock underlying Fort Devens consists mainly of low-grade metasedimentary rocks, gneisses, and granites. These rocks range in age from Late Ordivician to Early Devonian (approximately 450 million to 370 million years old). A generalized summary map (Fig. 3-3 in Vol. I of the 1993 Remedial Investigation report; ABB-ES, 1993) identifies bedrock immediately to the south of Grove Pond as the Berwick Formation, and the Devens-Long Pond facies of the Ayer Granite is immediately to the west. It is noted in the Remedial Investigation that formation boundaries are approximate because bedrock exposures in this area are limited. However, this map indicates that in the vicinity of Grove Pond, the contact between the Berwick Formation and the Devens-Long Pond facies appears to strike in a northerly direction, passing between the western shore of Grove Pond and the eastern edge of Plow Shop Pond, approximately under the railroad causeway.

Results of a seismic refraction survey (cf. CDM, 1993) conducted by Geoscience Services Associates Inc. in 1991 did not confirm the presence of bedrock along a traverse parallel to the southern shore of Grove Pond near the Town wells. At this location, the lower layer is interpreted as dense till and/or bedrock, overlain by unconsolidated sands and gravels and was encountered at depths ranging from 48 feet to 116 feet below ground surface. However, the results of the seismic survey are ambiguous. Therefore, the subsurface elevation of the bottom of the Town of Ayer production well screens with respect to a dense till/bedrock layer is unknown.

The Berwick Formation is described as primarily calcareous and biotitic metasiltstones and metasandstone (Robinson and Goldsmith, 1991). Two localized zones of mica schists and phyllites containing pyrite (FeS_2) and pyrrhotite ($Fe_{1-x}S$) have been identified within the Berwick Formation. Both of these zones are thin, elongate bodies oriented in a northeast-southwest direction. The western sequence lies between Townsend and Chelmsford, directly north of Ayer. This sequence is described as a quartz-rich pyrrhotitic schist containing aggregates of biotite. Cores of the Berwick Formation, taken in the vicinity of the Shepley's Hill Landfill, have been studied extensively (ABB-ES, 1995a). From these cores, the metasiltstone is described as calcareous, with secondary quartz and sulfides along bedding planes and fractures.

4.1.1 Arsenic Mineralogy

Sulfide minerals include a large number of compounds with the general structural formula A_mX_p. In these minerals, the larger atom, may be S, As, Sb, Bi, Se, or Te. In a few minerals, S and As or Sb are present in nearly equal amounts. The smaller atom, A, is one or more of a group of metals that includes Fe, Co, Ni, Cu, Zn, Ag, Cd, and Mo.

The group of sulfide minerals with the formula AX_2 includes pyrite (FeS_2), cobaltite (CoAsS), arsenopyrite (FeAsS), and gersdorffite (NiAsS). The substitution of small amounts of Ni and Co for Fe in pyrite is not uncommon, but the mineral bravoite $(Ni,Fe)S_2$, in which Fe is less than 50 mole percent, is rare. Arsenopyrite is the most abundant arsenic mineral. It forms at high to moderate temperatures and is often found in association with other sulfide minerals in contact-metamorphic rocks (Mason and Berry, 1968).

Arsenic may substitute for sulfur atoms in some sulfide minerals -- for example, in pyrite or chalcopyrite ($CuFeS_2$), paired As-S atoms may substitute for S_2. Alternatively, arsenic may be present in pyrite or other sulfide minerals as a discrete phase (such as arsenopyrite). Both occurrences are commonly observed. In a letter report (Prof. M. Williams, Dept. of Geosciences, U. Mass. - Amherst to M. Deuger, Army BRAC Office, May 8, 1996), electron microprobe analysis of a sample of granite from a gravel pile on Devens verified the presence of discrete grains of arsenopyrite as well as pyrite with detectable As. The lithologic unit from which the gravel pile was mined is unknown, but it is probable that this material was locally derived.

Pyrrhotite ($Fe_{1-x}S$), niccolite (NiAs) and breithauptite (NiSb) belong to the niccolite group of sulfide minerals, all of which have AX-type structures (Mason and Berry, 1968). Pyrrhotite occurs primarily in basic igneous rocks but has also been reported from contact metamorphic rocks, in high temperature hydrothermal veins, and in sediments. Pyrrhotite has been found in association with pyrite, chalcopyrite ($CuFeS_2$), pentlandite $(Fe,Ni)_9S_8$, and other sulfide minerals. Experimentally, arsenic has been shown to substitute in the pyrrhotite crystal structure, and arsenopyrite has been found as a pseudomorph after pyrrhotite (Deer, Howie, and Zussman, 1966).

In summary, the presence of sulfide mineralization in bedrock outcrops on and near Ft. Devens, the identification of sulfides in bedrock core samples from the Berwick Formation, and the unequivocal identification of cobaltite in a bedrock sample from the south shore of Grove Pond

(Gannett Fleming, 2002), indicate that arsenic minerals are commonly-observed, naturally occurring geologic constituents of the bedrock in the vicinity of Grove and Plow Shop Ponds.

4.2 Hydrogeology

The groundwater hydrology of the Grove Pond area has been explored through various field investigations and numerical modeling (e.g., CDM, 1993; ETA, 1995). Grove Pond lies in a topographic depression, and the water table in the surficial aquifer generally mimics the topography. Under unstressed conditions (i.e., in the absence of pumping), groundwater flow in the immediate vicinity of the Town of Ayer wells is from southwest to northeast, and discharges to the pond. Similarly, flow in the area immediately north of the pond is toward the south, again discharging to the pond. The water-table gradient in the unstressed state is approximately 0.008 ft/ft beneath the slope descending toward the pond from the Devens boundary, and decreases to approximately 0.002 ft/ft near the Town of Ayer wells (estimated from the water table map shown in Figure 4-1, CDM, 1993). Horizontal hydraulic conductivity for the aquifer is approximately 300 ft/day (CDM, 1993), consistent with a pump test performed on the Ayer wells, as well as various independent determinations in the area. The ratio of horizontal to vertical hydraulic conductivity is estimated to be 10:1.

Under pumping conditions, the groundwater elevations are drawn down by several feet at the Town of Ayer production wells, and flow is drawn from the surrounding area, including the aquifer beneath the pond. The conceptual model invoked by most studies to date represents the outwash sand beneath the pond as a "semi-confined" aquifer; that is, the lower-conductivity pond-bottom sediments "cap" the underlying sand, offering resistance to infiltration from the pond, and supporting a vertical head difference. Under pumping conditions, the head in the underlying sand is lower than that due to the standing pond water, and recharge from the pond to the aquifer is induced. The flux of pond water through the bottom sediment and into the underlying sandy aquifer is determined by the distribution of the groundwater potential in the aquifer and the thickness and vertical hydraulic conductivity of the pond-bottom sediment. It is emphasized that the hydraulic properties of the pond-bottom sediment, critical to calculating the induced infiltration, have not been measured directly, or inferred from calibration of numerical models. In model studies performed to date, the conductivity of the pond sediment layer has been assumed to be similar to that determined in nearby surface water bodies (CDM, 1993) or to be some fraction of stream-bottom values characteristic of the region (ETA, 1995).

4.3 Meteorology

The Fort Devens climate is typical of the northeastern United States: long, cold winters and short, hot summers. The coldest months are January and February, with mean daily minimum temperatures of 17 °F; July is the hottest month, with mean daily maximum temperature of 83 °F. The mean annual temperature is 58 °F. During a normal year, the temperature reaches or exceeds 90 °F on 12 days, and 134 days of the year the temperature is at or below freezing.

The 1993 Remedial Investigation (RI) report for Fort Devens (ABB-ES, 1993) summarizes local climatic conditions as follows: Average annual rainfall is 39 inches. Mean monthly precipitation varies from a low of 2.3 inches (June) to a high of 5.5 inches (September). Average annual snowfall is 65 inches. Most of the snowfall occurs between December and March, although snow has been reported for the months of September through May. Wind speed averages 5 miles per hour (mph). The highest monthly average is 7 mph (March and April), and the lowest monthly average is 4 mph (September). Average daytime relative humidities range from 71 percent (January) to 91 percent (August). Average nighttime relative humidities vary between 46 percent (April) to 60 percent (January).

At Worcester (MA) Municipal Airport, approximately 25 miles to the southwest of the site, average annual rainfall for the period 1931 to 1997 is 46.84 inches. Average monthly rainfall over the same period at Worcester is quite uniform, ranging from 3.10 inches in February to 4.40 inches in November. Although conditions at Ft. Devens may deviate slightly from those recorded in Worcester, approximately 30 miles away, the Worcester meteorological station is the nearest station with consistent, continuous data.

5.0 CONCEPTUAL MODELS

This chapter presents conceptual models and supporting information for the presence of the principal chemicals of potential concern (COPCs) in sediment in Grove and Plow Shop Ponds. In this section, information that is often presented separately as "Nature and Extent" and "Fate and Transport" has been combined to reduce redundancy and for clarity in discussing a rationale for the concentration, distribution, plausible source(s), and transport mechanism(s) for each element of interest. The emphasis of this section is on elements and/or compounds that have been identified in previous studies of the ponds or in the present effort as potentially significant from a risk perspective. In particular, the report focuses on arsenic (As), cadmium (Cd), chromium (Cr), mercury (Hg), and lead (Pb) in sediment. Briefer treatments of manganese (Mn) and vanadium (V) are given, as well.

Each of the key elements is treated in the following subsections. Each subsection, in turn, first offers a qualitative discussion of the concentrations and spatial distribution of the particular element. This discussion provides descriptive statistics for the element, and any observations of systematic variations within the system that may bear on interpretation of sources and transport processes. Second, a brief outline of the properties and processes believed to be of significance in the transport of the element in the ponds is given. Finally, a conceptual model is developed for the element. The conceptual model attempts to integrate what is known about historical activities around the ponds that may have contributed contaminants to the sediment, the spatial distribution of element concentrations, and the environmental behavior of the element. The objective of the conceptual model is to provide a general, interpretive framework that identifies likely source(s) and transport pathways for the element, and that is consistent with and supported by the available data. The depth of the discussion offered for each element is conditioned by the importance of the element with respect to the most recent human-health and ecological risk assessments (Sections 6.0 and 7.0, respectively). For that reason, arsenic and chromium, which are shown elsewhere to pose the most significant risks, are treated in somewhat more detail here.

It should be noted that the assessments provided in this section are based on a subset of the comprehensive database that was assembled in the course of completing the ESI. The comprehensive database attempts to bring together all available data from the many investigations that have been conducted on the ponds over approximately a 15 year time span. Although this large database has the potential to reveal systematic variations in contaminant concentrations at the scale of the ponds, and to provide relatively robust statistics, there are unavoidable inconsistencies within the data. The different investigations involved a variety of sponsoring agencies, sampling crews, field sampling methods, analytical laboratories, and evolving technologies. For these reasons, reported "non-detect" results from the laboratories imply a wide range of detection limits, and were discarded prior to calculating all sample statistics reported in this section. In addition, a number of results in the database were identified in review as questionable due to possible laboratory error, data transcription error, etc. These, too, were eliminated from the database prior to calculating descriptive statistics. That is, the discussion of conceptual models is based solely on what are believed to be "defensible" analytical results. Omission of non-detect analyses, rather than invoking some arbitrary substitution such as half the method detection limit, tends to bias the reported estimates of central tendency (i.e., arithmetic or geometric mean) high. The descriptive statistics summarized in this section are used solely for qualitative purposes to support the development of conceptual models for key elements.

In order to visualize the spatial distribution of key elements, bubble maps are provided for each element, with the exceptions of Mn and V. The data are presented for each pond separately, and for two depth intervals, 0-1 ft below the sediment/water interface ("shallow"), and >1 ft below the sediment/water interface ("deep"). The bubble maps display a name for every sample in the database; however, a bubble is plotted only for each detection. Non-detects are shown with the notation <MDL, where MDL is the reported detection limit. The area of each bubble is proportional to the concentration (in mg/kg) of the particular element displayed. Correspondingly, the diameters of the bubbles scale with the square root of the concentration. The bubble maps are provided in order to give a qualitative, visual impression of the distribution of detected concentrations. It is emphasized that the comprehensive data are assembled from all known sampling and analysis programs, and are not the result of a random sampling plan. For this reason, there are spatial biases in the database, e.g., higher sample density in known areas of concern, such as Tannery Cove in Grove Pond and Red Cove in Plow Shop Pond.

Histograms are presented for each element in each pond for the shallow (0-1 ft) sediment. The histograms show the frequency of occurrence of analyses within given ranges, based on $\log_{10}$-transformed concentrations (in mg/kg). It is often observed that various environmental parameters are log-normally distributed, and there is some indication that the measured concentrations of inorganics in the pond sediments tend toward this pattern. That is, the histograms of the log-transformed data are, in many cases, approximately Gaussian. The peak of such a histogram is centered on the geometric mean of the sample population, and the spread about that peak is measured by the geometric standard deviation. Elements that show marked departures from a log-normal distribution of concentrations, as well as a large spread in concentrations (i.e., large geometric standard deviation), are suggestive of anthropogenic inputs to the system. This is apparent, for example, in the histogram for chromium in shallow (0-1 ft) sediment in Grove Pond.

This section of the report does not attempt to address polycyclic aromatic hydrocarbons (PAHs), which have been detected in various locations in Grove and Plow Shop Ponds. Of particular note are detections in sediment in the vicinity of the former Railroad Roundhouse site on the south shore of Plow Shop Pond. Sediment toxicity tests conducted by EPA in 2005 using sediment from this area demonstrated lethal effects on both midge-fly larvae and amphipods. However, because most of the sediment sampling and analysis conducted over the past two decades has been directed primarily toward metals contamination, insufficient data are available to support the development of a conceptual model for PAHs. It is noted that additional investigation of sediment contamination immediately offshore from the Railroad Roundhouse is currently being undertaken by Army.

PCBs and pesticides also emerge from the present human-health risk analysis as risk drivers, and, like PAHs, are omitted from the discussion in this section. There are insufficient data for these analytes to support an interpretation of source(s) and transport.

5.1 Background:

According to the EPA guidance (2002), background is defined as:

1. *Naturally occurring*: present in the environment, not influenced by human activity

2. *Anthropogenic*: natural and man-made, present in the environment as a result of human activity but not specifically site-related

To date, there is no "sediment background" data set that has been collected explicitly for the purpose of establishing background concentrations of trace metals in Grove and Plow Shop Pond sediments. To assemble such a data set is difficult for the following reasons:

Data collected under a number of other programs (e.g., by Army, EPA, USF&W, USGS, etc.) suggest that the composition of groundwater discharging to these ponds is variable and location-dependent. Nevertheless, it has been documented that groundwater in the immediate vicinity of the ponds carries elevated levels of many of the elements of interest (particularly dissolved iron (Fe) and arsenic). Because the pond sediments are accumulating these elements through geochemical mechanisms such as sorption and precipitation, spatial variability, both vertically and laterally, in pond sediment composition is expected. It would be difficult to identify the number and location of pond sediment samples that adequately capture the range of conditions and concentrations represented in groundwater, even without consideration of any anthropogenic input.

In addition, both Grove and Plow Shop Ponds have existed, in an urban/industrial setting, for over 100 years. It is known that untreated tannery waste was discharged directly into Grove Pond at least throughout the first half of the 20th century (see, e.g., Gannett Fleming, 2002) and it is likely that other historical, industrial operations surrounding the ponds were also responsible for contributing some portion of the COPCs to the sediments. Unfortunately, records of operations and documentation of historical releases, either deliberate or unintended, are sparse. Thus, identifying the anthropogenic component of "background" in these sediments is extremely difficult.

Two sediment samples were obtained in Flannagan Pond and one was collected in Sandy Pond, both of which are located upstream from the study area. In addition, Norton, et al. (2001) analyzed one sediment core in Spectacle Pond, for comparison to cores that they collected from Grove Pond and Plow Shop Pond. However, the extent to which these ponds receive contributions from surface runoff, groundwater, and/or any anthropogenic sources that are different from inputs to Grove and Plow Shop Ponds is not known, and so these cannot be considered to represent "background" for the purpose of comparison to the subject ponds. In discussion of results from Flannagan, Sandy, and Spectacle Ponds, these locations will be referred to as "reference" areas rather than "background."

5.2 Pond Sediment Data Summary:

The following tables summarize descriptive statistics for seven key elements in each pond and for each of two depth intervals. Statistics for aluminum (Al) and iron (Fe) are also given because of their potential importance in the transport of the other metals. As noted in section 5.0, the dataset was first reviewed for questionable entries (e.g., possible faulty analyses, data-entry errors, etc.), and all non-detect (ND) results were omitted for the purpose of calculating the statistical parameters. In the following tables, the first column records the number of NDs present and the total number of samples present in the database. The succeeding columns display the arithmetic mean (AM), the arithmetic standard deviation (ASD), the minimum *detected* concentration (recall that, in many cases, lower concentrations may have been sampled, but are not considered if not detected), the maximum concentration, the geometric mean (GM) given as the arithmetic mean of the logarithm (base 10) of the concentrations, the geometric standard deviation (GSM) given in logarithmic (base 10) units, and the geometric mean given in mg/kg (GM (conc)). All concentrations are reported in mg/kg (ppm). Note that the descriptive statistics for vanadium and manganese are based only on data collected by EPA in 2004/2005, and thus represent a much smaller database than do those for the other elements shown in the tables. No deep (>1 ft) sediment from Grove Pond was analyzed in the EPA 2004/2005 program.

Tabulated Data for Grove Pond Sediments, 0-1 ft

	NDs/total	AM	ASD	min.	max.	GM	GSD	GM (conc)
Al	0 / 142	11200	13100	1320	90000	3.9024	0.3206	7990
Fe	0 / 142	15500	8640	93	42800	4.0985	0.3381	12500
Pb	2 / 142	271	337	3.29	1760	2.1248	0.5804	133
Hg	24 / 120	25.8	68.5	0.128	420	0.6080	0.7991	4.06
As	3 / 142	81.6	97.2	3.09	910	1.6975	0.4673	49.8
Cd	54 / 133	31.2	83.9	1	730	1.1193	0.5272	13.2
Cr	5 / 140	6050	12200	4.69	52000	2.6895	1.1243	489
V	0 / 17	66.5	39.7	22	140	1.76	0.24	57.3
Mn	0 / 17	981	469	70	1800	2.91	0.33	818

Note: NDs are not included in statistics

Tabulated Data for Grove Pond Sediments, >1 ft

	NDs/total	AM	ASD	min.	max.	GM	GSD	GM (conc)
Al	0 / 14	4770	1370	2060	7800	3.6602	0.1383	4570
Fe	0 / 14	5280	3260	1280	13900	3.6439	0.2828	4400
Pb	6 / 16	122	310	3.21	1000	1.2863	0.7854	19.3
Hg	3 / 10	27.1	55	0.0808	150	0.5369	1.087	3.44
As	7 / 16	167	426	2.86	1300	1.3983	0.7882	25.0
Cd	15 / 16	3.59		3.59	3.59	0.5551		3.59
Cr	0 / 16	3290	10900	4.69	44000	1.9721	1.2065	93.8

Note: NDs are not included in statistics

Tabulated Data for Plow Shop Pond Sediments, 0-1 ft

	NDs/total	AM	ASD	min.	max.	GM	GSD	GM (conc)
Al	1 / 108	8320	5370	388	27000	3.8106	0.3468	6470
Fe	0 / 108	58000	96300	428	410000	4.4217	0.5168	26400
Pb	9 / 108	188	210	3.88	1210	2.0042	0.5541	101
Hg	6 / 102	28.9	42.0	0.038	250	0.8721	0.8994	7.45
As	1 / 108	579	1060	3.49	6800	2.3365	0.6340	217
Cd	49 / 103	19.0	15.8	1.5	66	1.1316	0.3838	13.5
Cr	6 / 108	2590	4230	8.3	37800	2.9580	0.7827	908
V	5 / 20	39.2	22.5	7.1	80	1.50	0.32	31.8
Mn	0 / 20	3430	7350	130	34000	3.15	0.55	1410

Note: NDs not included in statistics

Tabulated Data for Plow Shop Pond Sediments, > 1 ft

	NDs/total	AM	ASD	min.	max.	GM	GSD	GM (conc)
Al	0 / 79	4950	4800	353	29000	3.5358	0.3875	3430
Fe	0 / 79	15900	31600	335	220000	3.7922	0.5587	6200
Pb	13 / 79	33.2	52.4	0.757	260	1.0554	0.6609	11.4
Hg	26 / 78	16.2	38.4	0.1	220	0.4027	0.8308	2.53
As	9 / 79	163	377	1.53	2500	1.5447	0.7668	35.1
Cd	71 / 79	97.7	166	3.6	430	1.2959	0.8306	19.8
Cr	12 / 77	477	999	4.6	5700	2.1027	0.7102	127
V	4 / 24	15.0	12.5	3.2	51	1.05	0.33	11.2
Mn	0 / 24	792	900	31	4500	2.68	0.49	475

Note: NDs not included in statistics

5.3 Arsenic

For comparison to Grove and Plow Shop Pond sediments, the following values are reported from the reference areas, as described above (Sec. 5.1):

Reference Area	**As Concentration (mg/kg)**
Flannagan Pond	110 and 55
Sandy Pond	47
Spectacle Pond*	18
Grove Pond*	~18-20
Plow Shop Pond*	~29-59

*Norton (2001) "background"

5.3.1 Distribution

5.3.1.1 Grove Pond

In Grove Pond surficial sediments (0 to 1 ft depth), 3 out of 142 samples reported non-detectable arsenic concentrations. Of the detected results, the arithmetic mean is 81.6 mg/kg and the geometric mean is 49.8 mg/kg (standard deviation of logs is 0.4673) (Fig. 5-1). Detected values range from 3.09 mg/kg to 910 mg/kg.

In deeper Grove Pond sediments (> 1 ft), 7 out of 16 samples reported non-detectable arsenic concentrations. Of the detected results, the arithmetic mean is 167 mg/kg and the geometric mean is 25.0 mg/kg (standard deviation of logs is 0.7882). Detected values range from 2.86

mg/kg to 1300 mg/kg. The sample reporting 1300 mg/kg, from Tannery Cove, is not only a statistical outlier but also is likely due to burial of tannery-contaminated material and thus is not true "deeper sediment." The next highest value in the deeper Grove Pond data set is 78 mg/kg. Without the 1300 mg/kg, the arithmetic mean of the Grove Pond deeper sediment arsenic concentrations is 25.6 mg/kg and the geometric mean is 15.3 mg/kg.

Arsenic values from shallow Grove Pond sediments are consistent with the upstream pond values, i.e. the arithmetic mean of 81.6 mg/kg is comparable to the values reported from Flannagan Pond (55 and 110 mg/kg) and Sandy Pond (47 mg/kg). There is at least one high value among the Grove Pond samples (the maximum observed, 910 mg/kg; GRD-92-03X, in Tannery Cove), and possibly a few more, but most of the data appear to be generally consistent with values reported from upstream locations. Overall, the data do not indicate that there has been extraordinary arsenic impact to Grove Pond sediments. There are a few elevated concentrations in and near Tannery Cove (e.g., GRD-95-27X, 340 mg/kg; Fig. 5-2), and it is possible that these sediments contain a component of contamination related to historical pesticide use at the tannery.

Data from the deeper Grove Pond sediments (Fig. 5-3) may be misleading because the sampling was biased toward Tannery Cove, and the "deep" samples probably were not always "deep." It is known that the sediments in the area of Tannery Cove have undergone considerable perturbation, including the deposition of fill in the cove, which would have buried earlier surficial sediments. Thus any tannery-related arsenic contamination may be present at depth when in fact it was originally deposited on the sediment surface. In addition, the deeper Grove Pond sediments comprise a small sample population (n = 9 reportable detections) and the geometric standard deviation is relatively large, reflecting this small sample size. The large scatter may be attributable to the few tannery-related high hits.

In the study by Norton, et al. (2001), arsenic concentrations are relatively low in the "asymptotic" portion of the sediment profiles (at a depth of approximately 50 cm; 18-20 ppm). The conceptual model developed by the authors of this study suggested that the arsenic was deposited from the "top down," so the deeper concentrations represent "ambient" material. However, this model neglects the possibility that some of the arsenic is accumulating in sediments by precipitation out of upwardly-discharging groundwater. It is known that groundwater on the south side of Grove Pond, in the vicinity of the Town of Ayer water-supply wells, is reducing and relatively high in dissolved arsenic and iron (maxima approximately 200 micrograms per liter and 22 mg/L, respectively; GF, 2002). This condition may exist elsewhere around Grove Pond as well as at other locations around Plow Shop Pond. When upward-moving, reducing groundwater reaches a redox boundary somewhere near the sediment-water interface and encounters more oxidizing conditions, the iron precipitates out as ferric oxides, hydroxides, or oxyhydroxides. These ferric iron phases are known for their capacity to sorb arsenic and other elements from solution. Thus, as groundwater passes through pond-bottom sediments, these elements may accumulate in the solid phase as a consequence of the redox controls on their mobility. Under this scenario, the sedimentary profile has an entirely different origin, and it may be perfectly consistent to find arsenic at higher concentration in the shallower sediment.

5.3.1.2 Plow Shop Pond

In Plow Shop Pond surficial sediments (0 to 1 ft depth), 1 out of 108 samples reported non-detectable arsenic concentrations. Of the detected results, the arithmetic mean is 579 mg/kg and the geometric mean is 217 mg/kg (standard deviation of logs is 0.6340) (Fig. 5-1). Detected values range from 3.49 mg/kg to 6800 mg/kg.

In deeper Plow Shop Pond sediments (> 1 ft), 9 out of 79 samples reported non-detectable arsenic concentrations. Of the detected results, the arithmetic mean is 163 mg/kg and the geometric mean is 35.0 mg/kg (standard deviation of logs is 0.7668). Detected values range from 1.53 mg/kg to 2500 mg/kg.

The average arsenic concentration in shallow sediments in Plow Shop Pond is notably higher than that in Grove Pond (579 mg/kg, compared to 81.6 mg/kg). However, it is apparent (see, e.g., Fig. 5-4) that the sampling in Plow Shop Pond has been biased toward Red Cove and the west side of the Pond. Because these areas were targeted for specific reasons (known high concentrations of arsenic and iron) and samples are not randomly located, the distribution and average arsenic concentrations in Plow Shop Pond cannot be considered to be "representative." The observed differences between arsenic concentrations in Grove Pond and Plow Shop Pond sediments are attributed primarily to differences in the groundwater chemistry that is discharging to the ponds. The southwest side of Plow Shop Pond, including Red Cove, is characterized by reducing groundwater bearing significantly elevated levels of dissolved arsenic (up to several hundred micrograms per liter). The reasons for the local / regional difference in groundwater compositions is not known at this point, but EPA is currently conducting a comprehensive study that focuses on groundwater-surface water interaction in Red Cove.

The database for deeper sediments in Grove Pond is small (n=9 detected values), with one sample reporting 1300 mg/kg; without this sample, the mean for Grove Pond deeper sediments is 25 mg/kg. The arithmetic mean of Grove Pond surface sediments is 81 mg/kg, suggesting a ratio of arsenic concentration in shallow sediments to deep sediments of approximately 3:1. In contrast, the concentrations in Plow Shop Pond sediments, both shallow and deep, are larger and the databases are larger (n = 107 and n = 70 detectable values, respectively). Overall, surface sediments in Plow Shop Pond are higher in arsenic (arithmetic mean = 579 mg/kg) than in Grove Pond, and the deeper sediments also report higher arsenic concentrations (163 mg/kg). However, the ratio of arsenic concentration in shallow sediments to deep sediments in Plow Shop Pond is also approximately 3:1. Thus, the observed distribution of arsenic in deep and shallow Plow Shop Pond sediments is consistent with the upward movement of groundwater bearing dissolved arsenic under reducing conditions and precipitation upon reaching a redox boundary near the sediment-water interface. A more detailed conceptual model is postulated in Sec. 5.3.3.

5.3.2 Transport Processes

The most common oxidation states in which arsenic occurs in the natural environment are +3, +5, and –3. In solution, the principal inorganic species are referred to as arsenate, or As(V), usually without regard to degree of protonation, and arsenite, As(III). Under moderately oxidizing conditions (ORP > +100 mV), arsenic occurs predominantly as As(V), while As(III) is present under moderately reducing conditions. As(V) sorbs more strongly, especially to hydroxide surfaces of iron, manganese, and aluminum. Cations, anions, and uncharged species are attracted to sites on these surfaces that may also be positively, negatively, or neutrally charged, i.e. represented as $Fe—OH_2^+$, $Fe—O^-$, and $Fe—OH^0$, respectively. Because As(III) species sorb less strongly, arsenic is both more mobile and more toxic in the trivalent state. The solubility, toxicity, mobility, and bioavailability of As(V) and As(III) have been addressed at length in a number of papers in the recent literature. Some excellent sources are the review papers by Bhumbla and Keefer, 1994; Smith et al, 1998; and Cullen and Reimer, 1989.

In oxygenated fresh waters in the pH range from ~5 to 9, the dominant As(V) species are $H_2AsO_4^-$ (from pH <3 to around pH 7) and $HAsO_4^{-2}$ (to pH ~11). The dominant As(III) species in this pH range is $H_3AsO_3^0$ (see, e.g., Cherry et al, 1979). The pH values measured in Grove Pond and Plow Shop Pond groundwater and surface water lie within this range. In anoxic systems, As(III) is the thermodynamically significant form. Under extremely reducing, acidic conditions and in the presence of sulfur, As_2S_3 (the mineral orpiment) or AsS (realgar) may form. At neutral to alkaline pH, thioarsenite species, including $AsS(SH)(OH)^-$, $As(SH)S_2^{2-}$, AsS_3^{3-} and $As(SH)_4^-$ complexes, may be important (Bostick et al., 2005).

The redox behavior of arsenic in natural systems is complex. Thermodynamically, As(V) should be the dominant form relative to As(III). A recent study of arsenic in groundwater in a glacial-till aquitard system presents evidence of the suitability of using the As(V)/As(III) redox couple as an indicator of the oxidation-reduction potential of the system (Yan et al, 2000). However, thermodynamically predicted As(V)/As(III) ratios are rarely observed, and it is probable that relative concentrations of these species are affected by microbial reactions.

Both pH and microbial activity influence the oxidation of arsenite to arsenate, and the reduction of arsenate to arsenite. Bacteria, fungi, and some plants convert inorganic arsenic to organic forms (e.g., various methylated species such as monomethyl and dimethyl arsenic). Some of the organic species are volatile (e.g. dimethyl arsine) but the predominant species are non-volatile or semi-volatile (Argonne National Laboratory, Human Health Fact Sheet, August 2005). Concentrations of organic arsenic species are controlled by the composition of the microbial population; nature and concentration of organic matter; redox conditions; pH; mineral composition; and moisture. A more detailed description of these processes, as well as an extensive discussion of the bacterial methylation of arsenic, and a discussion of the uptake of arsenic by terrestrial and aquatic plants, is found in Cullen and Reimer, 1989.

5.3.3 Conceptual Model

Arsenic is a naturally occurring element that is commonly found in New England soils and groundwater. Originally associated primarily with sulfide minerals in bedrock, arsenic is redistributed throughout the overburden by physical (e.g. glacial erosion and transport) and chemical processes (e.g., dissolution, precipitation, adsorption). In addition, anthropogenic arsenic sources include waste incineration, coal combustion, metal mining, pesticide and herbicide applications, and use as a wood preservative. Potential sources that may have contributed arsenic to Grove Pond and Plow Shop Pond include local apple orchards, the leather tannery, and numerous historical industrial operations surrounding the ponds.

Concentrations of arsenic in Grove and Plow Shop Ponds are clearly elevated in places and exceed some standard risk thresholds (e.g., secs. 6 and 7). One distinct "hotspot" occurs along the southwest shore of Plow Shop Pond (see Fig. 5-4). In July 2004, EPA sampled groundwater via GeoProbe at several points around Plow Shop Pond. Two of these were located immediately adjacent to Red Cove, in order to characterize the vertical distribution of arsenic and other parameters in groundwater discharging to the cove (EPA data, July 2004). Data from these vertical profiles show that ORP ranges from -133.9 mV (at a depth of 30-32 ft BGS immediately adjacent to Red Cove) to +94.7 mV (at a depth of 6-8 ft BGS near the Plow Shop Pond dam). Dissolved arsenic ranges from non-detect at 1 microgram per liter to several hundred ppb (maximum 740 ppb, at a depth of 14 ft below ground surface (BGS) near Red Cove); and dissolved iron is present at concentrations between 430 and 72000 micrograms per liter. ORP generally decreases with depth below ground surface, pH increases, and both iron and arsenic concentrations increase as ORP decreases (Fig. 5-6). The positive correlation between dissolved arsenic and iron observed in these data suggests that reductive dissolution of ferric oxyhydroxides in the overburden and release of sorbed constituents is responsible for the elevated arsenic in groundwater discharging toward the Cove. When this reducing groundwater reaches a redox interface, the ferrous iron in solution forms a number of phases that sorb arsenic and other dissolved trace metals (LaForce et al., 2000; Harrington et al., 1998; Brannon and Patrick, 1987; and Moore et al., 1988).

The association of reducing groundwater with high Fe and high As concentrations is observed throughout the region. While the presence of Shepley's Hill Landfill may be a factor in mobilization of Fe and As in groundwater reaching Red Cove, the extent to which anthropogenic versus natural processes are responsible for high As concentrations in Plow Shop Pond (specifically in Red Cove) is currently unknown. Ongoing investigations by the EPA and Army may provide additional insights into the cause of the low-ORP, high-Fe, high-As groundwater on the east side of the landfill. In the fall of 2005, EPA Office of Research and Development (ORD) personnel began a focused investigation of groundwater-surface water interaction in the vicinity of Red Cove. A key objective of their study is the identification of the processes that control arsenic behavior at Red Cove. As part of this study, groundwater, surface water, pore water, and sediments have been sampled and will be characterized for a more comprehensive understanding of the mechanisms that determine arsenic mobility at this location. Documentation is anticipated in 2007. In addition, Army is undertaking a Comprehensive Site Assessment and a Corrective Action Alternative Analysis for Shepley's Hill Landfill, which may also provide insight into the relationships between the landfill, groundwater geochemistry, and groundwater – surface water interaction. Pending results of these studies, no definitive conclusions can be drawn regarding the role of the landfill in mobilizing arsenic transport to Red Cove. This question is beyond the scope of the present report.

Conclusions (Arsenic):

The following points are offered in support of the 'weight of evidence' conclusion that elevated levels of arsenic in Grove Pond and Plow Shop Pond sediments, particularly in the vicinity of Red Cove, are due to accumulation from groundwater:

- Low-ORP, high-Fe, high-As groundwater is known to be discharging toward the Cove (supported by EPA 2004 groundwater data);
- Presence of low-ORP, high-Fe, high-As groundwater and high-As sediments elsewhere, at locations not impacted by landfills (e.g., Grove Pond);
- Observed oxidation and precipitation of iron, as Fe(III) oxide phases, in Red Cove sediments (i.e., the red floc often observed on the sediment surface);
- Known affinity of hydrous ferric oxides for arsenic and other trace metal species in solution, resulting in the observed association of Fe and As in a fixed ratio in pond sediments (Fig. 5-7);
- Decrease in sediment arsenic concentration along west side of Plow Shop Pond, approaching the 'hinge' where the more oxidizing pond water is recharging groundwater;
- Lack of a plausible anthropogenic explanation for fairly uniform but elevated As concentrations in sediments across both Grove and Plow Shop Ponds (with the exception of Red Cove), both of which are shallow, low-energy environments unfavorable to large-scale sedimentary mixing;
- Accumulation of arsenic in sediments at redox boundaries is a recognized phenomenon.

In addition, arsenic may be precipitating in pond sediments in sulfide phases that may include either discrete As-sulfides such as orpiment (As_2S_3) or realgar (As_2S_2), or in association with Fe-sulfides (Huerta-Diaz et al., 1998). Although this mechanism is incompletely understood at present, the formation of arsenic phases under sulfidic conditions is the subject of ongoing research (e.g., Wilkin and Ford, 2002; Wilkin, 2001; Wilkin et al., 2002). The precipitation of realgar has been reported in marine sediments (O'Day et al., 2004) and the precipitation of arsenic sulfides has been postulated as an explanation of the observed decrease in aqueous arsenic concentrations in very low-ORP groundwater at several sites in New England (Stein, et al., 2005). While no data currently exist to support the occurrence of this mechanism in sediments from Grove or Plow Shop Pond, EPA investigators (study in progress; Ford et al., 2006) have observed zones of black, organic-rich sediment in shallow cores taken in Red Cove. Results obtained by Ford and co-workers from such intervals will yield insights into the nature of As or As-Fe phases forming under anoxic conditions in Plow Shop Pond sediments.

In Grove Pond, another "hotspot" is observed in the vicinity of Tannery Cove. It is probable that arsenical pesticides were used at the tannery, but this mass contribution is minor compared to contributions from groundwater (see, e.g., Fig. 5-1), especially on the southwest shore of Plow Shop Pond. Sample GRD-95-26, located in Tannery Cove and at a depth of 3 ft, reported 1000 mg/kg Pb and 1300 mg/kg As, which may be indicative of the use of lead arsenate, an insecticide that first came into use in Massachusetts in 1892 (Peryea, 1998). In the same sample, Cr and Hg are reported at 44000 mg/kg and 150 mg/kg, respectively, and these elements are also consistent with tannery-related chemicals. It is apparent that this sample contains some component of contamination from the tannery, but the depth of this sample suggests that the contamination was initially a surficial deposit that was subsequently buried by fill.

5.4 Cadmium

5.4.1 Distribution

Cadmium does not prove to be a major risk driver for either human health or ecological receptors in the present assessment (Secs. 6 and 7). However, it has been singled out previously as a contaminant of potential concern (e.g., ABB, 1995). For this reason, a brief discussion of the distribution of cadmium in the ponds is offered here for completeness. For comparison to Grove and Plow Shop Pond sediments, the following values are reported from the reference areas, as described above (Sec. 5.1):

Reference Area	Cd Concentration (mg/kg)
Flannagan Pond	11 and 13
Sandy Pond	<3
Spectacle Pond*	0.44
Grove Pond*	~0.2 – 0.38
Plow Shop Pond*	~<0.2 – 0.58

*Norton (2001) "background"

5.4.1.1 Grove Pond

The distribution of cadmium detections in shallow (0-1 ft) sediment samples from Grove Pond is shown in Figure 5-8. There is no obvious spatial pattern of cadmium concentrations. The maximum detection is 730 mg/kg, in a sample at the west end of the pond, adjacent to the railroad causeway. This is an outlier within the available data; the next highest detection is 130 mg/kg, located in the center of the pond. Cadmium was not detected in 54 of 133 samples in the database for shallow sediment. The arithmetic mean of the 79 detections is 31.2 mg/kg; the geometric mean is 13.2 mg/kg (Fig. 5-9). The geometric mean is nearly identical to that for Plow Shop Pond detections (13.5 mg/kg). That is, this measure of central tendency does not distinguish the two ponds.

Based on his own more limited sampling (three cores and ten surface grab samples), Norton (2001) suggests that there is a preponderance of higher concentrations in the eastern end of Grove Pond. Based on the comprehensive data displayed in Figure 5-8, this pattern is not strongly supported. Norton calculated an arithmetic mean of 12 mg/kg for his ten surface sediment samples, within a factor of 2 to 3 of the mean calculated for the comprehensive data set.

Cadmium was detected in the two upstream reference samples from Flannagan Pond at 11 and 13 mg/kg, and was ND (<3 mg/kg) in the single upstream reference sample from Sandy Pond. Based on this very small sample set, there is nothing to distinguish shallow-sediment Cd detections in the upstream reference ponds from those in Grove Pond.

Sampling of deep (>1 ft) sediment in Grove Pond is relatively sparse, and Cd was detected in only one of fifteen samples, at a concentration of 3.59 mg/kg (Fig. 5-10). Based on these limited data, it appears that cadmium concentrations at depth are lower overall than those in the upper 1 ft of sediment.

5.4.1.2 Plow Shop Pond

The distribution of cadmium detections in shallow (0-1 ft) sediment samples from Plow Shop Pond is shown in Figure 5-11. There is some suggestion that the higher detections tend to be more concentrated toward the western shore. The maximum detection is 66 mg/kg, in a sample in the southwest portion of the pond known as Red Cove. Cadmium was not detected in 49 of 103 samples in the database for shallow sediment. The arithmetic mean of the 54 detections is 19.0 mg/kg; the geometric mean is 13.5 mg/kg (Fig. 5-9). The geometric mean is nearly identical to that for Grove Pond detections (13.2 mg/kg). That is, this measure of central tendency does not distinguish the two ponds.

For comparison, Norton (2001) reports an arithmetic average for Cd in 10 shallow-sediment grab samples of 6 mg/kg, about one third of the result for the larger database considered here. The estimates of central tendency for Cd in shallow sediment in Plow Shop Pond (arithmetic mean: 19.0 mg/kg; geometric mean: 13.5 mg/kg) are comparable to the single-sample results for the upstream reference ponds (one ND, and detections of 11 and 13 mg/kg).

The majority of deep sediment samples (>1 ft) from Plow Shop Pond (Fig. 5-12) did not yield detectable cadmium; 71 of 79 samples were ND. Two samples show anomalously high detections. The highest cadmium concentration found in deep Plow Shop Pond sediment is 430 mg/kg at a depth of 1.5 ft, immediately off the Railroad Roundhouse site (PSPC09). The other high detection is in Red Cove (PSPC19), with a concentration of 290 mg/kg at a depth of 3.5 ft. The arithmetic mean of the 8 detections in deep sediment is 97.7 mg/kg; the geometric mean is 19.8 mg/kg. Note that these values are not indicative of the central tendency across the pond, because they give no weight to the non-detects, which dominate the overall dataset. In addition, it is noted that both the area off the Railroad Roundhouse site and the area of Red Cove may have received an input of sediment due to various site activities (e.g., erosion from the steep slopes between the roundhouse and the pond and between Shepley's Hill Landfill and the pond), so that "deep" (>1 ft) sediment may have been closer to the sediment – water interface in relatively recent years.

5.4.2 Transport Processes

Cadmium occurs as Cd^{2+} and in a variety of Cd(II) solids (e.g., CdO, $CdCO_3$, $CdCl_2$, $CdSO_4$, CdS). Like other metal cations, cadmium sorbs onto oxyhydroxides of Fe, Al, and Mn. In an aqueous environment, cadmium will eventually precipitate as an oxide or a sulfide, depending upon local redox conditions and the availability of reduced sulfur.

5.4.3 Conceptual Model

Cadmium appears to be somewhat elevated in Grove Pond and Plow Shop Pond shallow sediment relative to what might be considered "background" for the area. Norton (2001) collected and analyzed a core from Spectacle Pond, located about 3.5 miles to the east, as representative of a nearby pond not subject to historical industrial activities. The highest Cd detected in the Spectacle Pond core was 1.64 mg/kg. In contrast, central tendency estimates for Grove and Plow Shop Ponds shallow sediment (0-1 ft) are of the order of tens of mg/kg. Cadmium in the ponds generally shows no systematic spatial variation in map view, suggesting that its presence may be related to widespread urban and industrial activities surrounding the ponds. Scattered high values, such as the 730 mg/kg detection near the western shore of Grove Pond, may reflect sporadic, local sources. There is a suggestion of higher concentrations (of the order of tens of mg/kg) along the southern and western shores of Plow Shop Pond (Fig. 5-11). It is possible that the Cd originates in adjacent soils, and that the clastic sedimentation rate is somewhat higher in these areas because of relatively steep slopes and some bare ground on the shore. This speculation is further supported by the observation of detections of Cd in the deep (>1 ft) sediment in the same areas. Elsewhere, there is a striking contrast between shallow sediment (0-1 ft), in which nearly half of all samples show detectable cadmium, and deeper sediment (>1 ft), in which Cd was detected in less than 10% of all samples.

Cadmium enters the environment via a number of uses. It is present in petroleum and coal, and is consequently released to the atmosphere in combustion products, and subsequently deposited to surface soil and water. In addition, particulates from tire wear contribute Cd near roads (California Air Resources Board, 2004). Cadmium is used extensively in batteries. One possible use near the ponds is in vented Ni-Cd batteries, often used in diesel locomotives, which are known to release Cd to the environment (Dartmouth Toxic Metals Research Program, 2005). Cadmium is also widely used as a pigment in paints, plastics, ceramics, enamels, and glass; its use in dyes goes back to the 19th century and before. Historical maps and drawings of the Town of Ayer show an industrial facility on the north shore of Plow Shop Pond in the late 19th century labeled Nashoba Mordant and Dye Company; it is unknown whether or not this business manufactured or handled cadmium-based pigments. Other possible industrial users of Cd include the former tannery and the present-day plastics business on the northwest shore of Grove Pond. Cadmium is added to plastics not only as a pigment, but also as a stabilizer against degradation by light and temperature (ATSDR, 1999). Cadmium has been used in rare instances in the tanning process (Dartmouth Toxic Metals Research Program, 2005), but there is no indication of a spatial association with the tannery site on Grove Pond, or any apparent correlation with more unequivocal tannery contaminants, such as chromium.

Detections of Cd at concentrations of several hundred mg/kg in deep Plow Shop Pond sediment adjacent to the Railroad Roundhouse and in Red Cove appear to be isolated, and are of unknown origin. Both areas may have been subject to relatively rapid sedimentation due to erosion of the steep slopes between the roundhouse and the pond and between Shepley's Hill Landfill and the pond, so that material that was at the sediment – water interface during the 20th century is now buried to depths up to several feet.

It is noted in the comprehensive data for sediment in Grove and Plow Shop Ponds that there is a rather strong empirical correlation between cadmium and lead. Figure 5-13, for example, shows that the ratio of Pb to Cd is constant over the upper 15 cm of Grove Pond Core #1 analyzed by Norton (2001). Such a correlation is suggestive of either a common source (i.e., Cd and Pb were released to the environment in a roughly fixed proportion, which is retained through their transport and accumulation processes in the ponds), or common controls on transport once in the environment (i.e., the sources may be different, but the predominant transport processes tend to distribute the metals spatially in a similar fashion). The former scenario is consistent, for example, with a source in combustion of leaded fuels with minor Cd impurities. At depth (Fig. 5-13), the Cd concentrations decrease more rapidly than do the Pb concentrations; no explanation for this systematic variation has been identified.

In summary, cadmium is somewhat elevated in shallow sediment across both ponds, at geometric mean concentrations of the order of 10 mg/kg. The widespread presence of Cd is likely attributable to deposition from the atmosphere and from particulates carried to the ponds in stormwater runoff. In addition, there are sporadic, local concentrations of the order of hundreds of mg/kg, possibly related to historical industrial and transportation activities around the ponds.

Specific discrete sources are not indicated by the available data, and ultimate sources of release remain unknown.

5.5 Chromium

5.5.1 Distribution

For comparison to Grove and Plow Shop Pond sediments, the following values are reported from the reference areas, as described above (Sec. 5.1):

Reference Area	Cr Concentration (mg/kg)
Flannagan Pond	21 and 14
Sandy Pond	27
Spectacle Pond*	24
Grove Pond*	~30-35
Plow Shop Pond*	~8-50

*Norton (2001) "background"

5.5.1.1 Grove Pond

In Grove Pond surficial sediments (0 to 1 ft depth), 5 out of 140 samples reported non-detectable chromium concentrations. Of the detected results, the arithmetic mean is 6050 mg/kg and the geometric mean is 489 mg/kg (standard deviation of logs is 1.1243) (Fig. 5-14). Detected values range from 4.69 mg/kg to 52000 mg/kg.

In deeper Grove Pond sediments (> 1 ft), 0 out of 16 samples reported non-detectable chromium concentrations. The arithmetic mean is 3290 mg/kg and the geometric mean is 93.8 mg/kg (standard deviation of logs is 1.2065). Detected values range from 4.69 mg/kg to 44000 mg/kg.

Chromium concentrations in sediments from the reference areas are remarkably uniform, generally around ~ 20 to 30 mg/kg, suggesting that this is a "typical" ambient Cr value. However, extreme values – up to three orders of magnitude higher than the background range – are likely due to anthropogenic impacts. The distribution of these extreme concentrations (Fig. 5-15) indicates an association with the former tannery, with some transport to the east and also to the west, through Plow Shop Pond. Also, the very high values in deep sediment (Fig. 5-16) are located in Tannery Cove. Although initially tannery-related and likely the result of surface deposition, these concentrations are found in sediments that are now deep due to burial by in-filling of the cove. The standard deviations of the logarithmically transformed data from Grove and Plow Shop Ponds are high, due to the large spread in the data. Figure 5-14 shows the distributions of Cr data from Grove and Plow Shop Ponds.

In addition to the high Cr concentrations found near the former tannery site, two sediment samples from the southwest cove of Grove Pond exhibit elevated Cr. Samples GRD-95-29X and GRD-95-46X are reported at 20400 mg/kg and 2010 mg/kg, respectively. The higher of these two is among the samples exhibiting a correlation between Cr and Hg, suggesting a possible association with tannery-derived contamination.

5.5.1.2 Plow Shop Pond

In Plow Shop Pond surficial sediments (0 to 1 ft depth), 6 out of 108 samples reported non-detectable chromium concentrations (Fig. 5-17). Of the detected results, the arithmetic mean is 2590 mg/kg and the geometric mean is 908 mg/kg (standard deviation of logs is 0.7827) (Fig. 5-14). Detected values range from 8.3 mg/kg to 37800 mg/kg.

In deeper Plow Shop Pond sediments (> 1 ft), 12 out of 77 samples reported non-detectable chromium concentrations (Fig. 5-18). The arithmetic mean is 477 mg/kg and the geometric mean is 127 mg/kg (standard deviation of logs is 0.7102). Detected values range from 4.6 mg/kg to 5700 mg/kg.

5.5.2 Transport Processes

The most common oxidation states of chromium are Cr^0, Cr^{+3} (trivalent chromium) and Cr^{+6} (hexavalent chromium). Most naturally occurring chromium is in the form of Cr(III), while anthropogenic chromium enters the environment usually as Cr(III) or Cr(VI). Most Cr(VI) salts have high solubilities, while the solubilities of Cr(III) solids (oxides, hydroxides, or oxyhydroxides) are low, of the order < 0.05 parts per billion at pH = 6 (James, 2002). Chromate is a strong oxidant, and Cr(VI) is relatively easily reduced in the environment by interaction with such common reductants as Fe(II) and organic matter (Rai et al., 1989). The oxidation of Cr(III) to Cr(VI) is slow and controlled primarily by Mn-oxide. Cr(III) either sorbs or precipitates readily, through adsorption onto ferric oxyhydroxides; by precipitation as a discrete Cr-oxide or oxyhydroxide; or through substitution of Cr^{+3} for Fe^{+3}, due to their similar ionic radius and charge, and precipitation as a mixed Cr^{+3}--Fe^{+3}oxide, hydroxide, or oxyhydroxide, e.g. $(Cr_xFe_{1-x})(OH)_3$. In the pH range from 4 to 9 and at redox potentials (Eh) between approximately +250 and +750 mV, the dominant Cr(VI) species in solution are $HCrO_4^-$ and CrO_4^{-2}. At lower Eh and with increasing pH, Cr(III) species are Cr^{+3}, $Cr(OH)^{+2}$, $Cr_3(OH)_4^{+5}$, $Cr(OH)_2^+$, and $Cr(OH)_{3(aq)}$ (calculated using Geochemist's Workbench; Bethke, 19xx; at 25 °C, chromium activity = 10^{-5}). In solution, aqueous concentrations of Cr(VI) are controlled mainly by adsorption/desorption and precipitation/dissolution reactions under neutral to acidic conditions, while Cr(III) concentrations are determined primarily by precipitation/dissolution of Cr(III) solids (Rai et al., 1989).

The solubility of Cr(III) may be enhanced by complexation or chelation with organic molecules. It is known, for example, that organic acids containing carboxyl groups (e.g., --RCOOH) can coordinate with Cr(III) to form complexes that may remain in solution for days to months.

Factors affecting the solubility of Cr(III) in these forms include pH, light, concentration and molecular weight of organic acids, and microbial activity (James, 2002; James and Bartlett, 1983; Srivastava et al., 1999). The accumulation of Cr by aquatic plants is also known (e.g., Cossich et al., 2002). The large amount of aquatic vegetation observed in both Grove and Plow Shop Ponds may have played a significant role in the distribution of chromium, originating at the former tannery site, in pond sediments. However, the extent to which chromium transport in the ponds has occurred, either as organic complexation of Cr(III) or sorption/uptake by aquatic plants, is unknown and cannot be determined from currently available data.

5.5.3 Conceptual Model

Known uses of chromium (both Cr(III) and Cr(VI)) include chrome plating operations, the manufacture of dyes and pigments, steel-making, leather tanning, wood preservation, and as rust and corrosion inhibitors and algaecides in industrial processing water. In addition, chromium compounds are also used in the textile industry as mordants, and lead chromate ("chrome yellow") is a pigment that is used in paints, plastics, and printing ink. At least two historical industries that may have used some of these chromium compounds were located in the immediate vicinity of the ponds, including the Nashoba Mordant and Dye Company, located at the northern end of Plow Shop Pond, and the tannery at the northwest corner of Grove Pond.

In the leather-tanning process, chromium salts are commonly used, most often as a basic Cr(III) sulfate. Hides are pickled in an acidic solution at a pH of 3, the chrome solution is introduced, and the pH is increased. Because the tannery discharged an untreated waste stream directly into Grove Pond from the beginning of operations in the mid-19th century until the middle of the 20th century, it is likely that Grove and Plow Shop Pond sediments contain some component of tannery-related chromium contamination. Some Cr (III) precipitates as mixed Cr-Fe oxide or is removed from solution by adsorption onto Fe (and/or Al, Mn) oxides in sediment. In addition, organic complexation of Cr(III) and/or uptake of Cr by suspended aquatic vegetation can enhance chromium mobility and may account for the observed distribution in pond sediments, particularly in Plow Shop Pond. Such processes may also bear on the apparently anomalous detection of chromium at 20,400 mg/kg in the southwest cove of Grove Pond.

The Massachusetts Department of Environmental Protection performed an investigation of the former tannery site in 1999 (MADEP, 2000) that included sampling of soils and groundwater, as well as adjacent sediment and surface water in Tannery Cove. Although high concentrations of chromium were detected in site soils (maximum 63,800 mg/kg at 9-11 ft bgs in the boring for MW-6), groundwater concentrations were relatively low (maximum (dissolved) 69 µg/L at PZ-1R, November 1999). The MADEP concludes, Calculations based on data from the piezometers, seepage meters, and monitoring well indicate that under current conditions, transfer of metals from groundwater to Grove Pond sediments near the PDC site is not a significant source of metals in the sediments." (MADEP, 2000, sec. 9.40, p. 30)

It is notable that chromium concentrations in shallow (0-1 ft) sediments are ubiquitously high across Plow Shop Pond (Fig. 5-17); many samples report Cr at least two orders of magnitude above the reference area concentrations. Although there is little doubt that the tannery contributed significant quantities of chromium to the pond system, questions of additional sources and transport mechanisms remain open to speculation.

Elevated concentrations (of the order of thousands of mg/kg) are found in deep sediment (>1 ft) along the southern and western shores of Plow Shop Pond (Fig. 5-18). It is possible that the Cr was originally deposited at the water/sediment interface, and subsequently buried to appear in "deep" sediment. As noted in the discussion of Cd in deep Plow Shop Pond sediment (sec. 5.4.3), there are suggestions that the clastic sedimentation rate is somewhat higher along the southern and western shores because of relatively steep slopes and some bare ground.

Chromium may have been used to treat industrial-process waters that were discharged to one or both ponds, as an algaecide or a rust inhibitor. A good-faith effort was made to search the records of the Town of Ayer for any information that such treatments might have contributed to the Cr load in pond sediments, without success. Inquiries to the Town of Ayer regarding this question did not produce any response, so any direct anthropogenic contributions cannot be established with certainty.

Conclusions (Chromium):

Any interpretation is largely speculative, given the available data and information on industrial use or discharge of these elements. Nevertheless, the following points are offered in support of the 'weight of evidence' conclusion that elevated levels of chromium in Grove Pond and Plow Shop Pond sediments are due to waste discharged by the former tannery and transported by dissolved or suspended organic matter:

- Cr(III) may remain in solution for long periods when in the form of organic complexes

- Uptake/accumulation and mobilization by aquatic vegetation is a plausible mechanism, given the amount of biomass in each of the subject ponds

- The highest Cr concentrations and the highest Pb concentrations are strongly correlated ($R^2 > 0.9$) and are found in sediments from Tannery Cove (Fig. 5-19). Elsewhere in both ponds, the correlation between Cr and Pb is weak or non-existent. This observation is consistent with postulated uses of both Cr (in the tanning process) and Pb, possibly as an arsenate pesticide, at the tannery.

- Chromium is correlated with mercury in both Grove and Plow Shop Pond sediments (Fig. 5-20), suggesting a possible common source and transport mechanism (see Conceptual Model for Hg in Sec. 5.6.3). The data shown in Fig. 5-20 for Grove Pond sediments indicate two possible Cr/Hg trends, possibly indicating that two different mechanisms may be responsible for their behavior in pond sediments, such as abiotic and inorganic adsorption (e.g., onto Fe(III) phases) and organic and/or aquatic-plant controlled uptake and deposition.

5.6 Mercury

5.6.1 Distribution

For comparison to Grove and Plow Shop Pond sediments, the following values are reported from the reference areas, as described above (Sec. 5.1):

Reference Area	Hg Concentration (mg/kg)
Flannagan Pond	0.3 and 0.3
Sandy Pond	0.62
Spectacle Pond*	0.112
Grove Pond*	~0.090 – 0.180
Plow Shop Pond*	~0.170 – 2.323

*Norton (2001) "background"

5.6.1.1 Grove Pond

The distribution of mercury detections in shallow (0-1 ft) sediment samples from Grove Pond is shown in Figure 5-21. There is a clear preponderance of higher concentrations in the northwestern portion of the pond, known as Tannery Cove. The maximum detection is 420 mg/kg, in a sample in this area (GRD-92-03X). The second highest detection is also in Tannery Cove, at 340 mg/kg (GP13). Mercury was not detected in 24 of 120 samples in the database for shallow sediment. The arithmetic mean of the 96 detections is 25.8 mg/kg; the geometric mean is 4.06 mg/kg (Fig. 5-22). (Note that the apparent anomaly on the bubble plot (Fig. 5-21) in the far SW cove of Grove Pond is a data-entry error. The reported Hg concentration there is 4.22 mg/kg. It is entered in the database at 422 mg/kg. The sample number is GRD-95-44X.)

Based on a smaller sample set of ten surface grabs, Norton (2001) calculated an arithmetic mean of 29.3 mg/kg, very close to that computed for the comprehensive dataset discussed in the foregoing.

Mercury was detected in the two upstream reference samples from Flannagan Pond at 0.3 mg/kg, and in the reference sample from Sandy Pond at 0.62 mg/kg. Based on this limited comparison, it appears that mercury is significantly elevated in shallow Grove Pond sediment relative to the upstream reference ponds, particularly in the area of Tannery Cove. It is emphasized again that the central tendency estimates for the comprehensive data are based on detections only, and are therefore biased high with respect to the pond-wide mercury concentrations.

Sampling of deep (>1 ft) sediment in Grove Pond is relatively sparse (Figure 5-23), and Hg was detected in seven of ten samples. Although there is a suggestion of higher detections in the Tannery Cove area, this conclusion is tentative because of the paucity of samples across the majority of the pond. The arithmetic mean of the seven detections is 27.1 mg/kg; the geometric mean is 3.44 mg/kg. These central-tendency estimates are strongly influenced by a few high detections in the Tannery Cove area, and are not representative of the pond as a whole. The maximum concentration detected in deep sediment is 150 mg/kg (GRD-95-26X) at a depth of 3 ft. The next highest detection is also in Tannery Cove, 28 mg/kg (GRD-95-27X) at a depth of 5 ft. It is noted that the area off the former tannery site is known to have been subject to filling, so that "deep" (>1 ft) sediment was likely closer to the sediment – water interface in relatively recent years.

5.6.1.2 Plow Shop Pond

The distribution of mercury detections in shallow (0-1 ft) sediment samples from Plow Shop Pond is shown in Figure 5-24. No spatial pattern is apparent; the higher detections are scattered widely across the pond. The maximum detection is 250 mg/kg, in a sample from the northwest portion of the pond near the opening of the outlet cove. Mercury was not detected in only 6 of 102 samples in the database for shallow sediment. The arithmetic mean of the 96 detections is 28.9 mg/kg; the geometric mean is 7.45 mg/kg (Fig. 5-22). These measures of central tendency are both higher than those for shallow sediment in Grove Pond (25.8 mg/kg and 4.06mg/kg, respectively).

For comparison, Norton (2001) reports an arithmetic average for Hg in 10 shallow-sediment grab samples of 18.4 mg/kg, about 36% lower than the result for the larger database considered here. Mercury was detected in the three samples from the two upstream reference ponds at 0.3, 0.3, and 0.62 mg/kg. Based on this limited characterization of the reference ponds, it appears that Hg is elevated in shallow sediment in Plow Shop Pond relative to upstream areas.

Mercury in deep sediment samples (>1 ft) from Plow Shop Pond is also elevated relative to available reference values. 26 of 78 available deep sediment analyses are non-detect. The arithmetic mean of the 52 detections is 16.2 mg/kg; the geometric mean is 2.53 mg/kg. There is some suggestion that the higher concentrations of mercury in deep Plow Shop Pond sediment tend to be found along the western shore (Figure 5-25). The maximum detection of Hg in deep sediment is 220 mg/kg, obtained for sample PSPC19 at a depth of 3.5 ft, located in Red Cove. Other relatively high detections in deep sediment are at PSPC15 at a depth of 1.5 ft (117 mg/kg), at the mouth of the northwest outlet cove, and at PSPC17 at a depth of 1.5 ft (96 mg/kg), near the northwest shore, south of PSPC15. Note again that it is possible that sedimentation along the western shore, perhaps due to erosion of the steep slope between Shepley's Hill Landfill and the pond, may have buried sediment formerly closer to the sediment – water interface.

5.6.2 Transport Processes

Mercury occurs in three oxidation states. Hg(0) is present either as a liquid at room temperature or as a gas (95% of Hg in the atmosphere is Hg^0). Mercury can exist in soil and water in a number of Hg(I) and Hg(II) species. The dominant process controlling Hg transport appears to be the sorption of nonvolatile forms to particulates in soil or in the water column and subsequent deposition in sediments (Hurley, et al., 1991). Mercury is transformed by biotic and abiotic oxidation and reduction reactions, bioconversion of inorganic and organic forms, and photolysis. Inorganic Hg can be methylated by aerobic and anaerobic microorganisms. In the pH range 4-9 and in the presence of sulfide, Hg^{+2} will precipitate as a sulfide with low solubility (approximately 10^{-15} to 10^{-16} micrograms per liter (ATSDR 1999)). If pH is low and Hg concentrations sufficiently high, methylHg is favored, and has greater bioavailability than inorganic forms.

5.6.3 Conceptual Model

Mercury is clearly elevated in Grove Pond and Plow Shop Pond shallow sediment (geometric mean concentrations of ~4 and ~ 7 parts per million, respectively; maximum detections of 420 and 250 ppm, respectively) relative to the upstream ponds (detections of a few tenths of a ppm). In Grove Pond, there is a clear spatial association of the higher Hg detections with the former tannery site in the northwest portion (Fig. 5-21). Upstream of the tannery (i.e., in the eastern portion of Grove Pond), Hg detections are typically <1 mg/kg. In the vicinity of Tannery Cove, concentrations rise to tens to hundreds of mg/kg. This spatial distribution is strongly suggestive of a source of mercury at the historical tannery, consistent with its possible use as a fungicide in hide storage or use in the tanning process itself. Mercury salts used in the leather tanning industry include mercuric (Hg(II)) chloride, mercury oxide (yellow), mercury oxide (red), ammoniated mercuric chloride, mercurous chloride calomel, and mercuric iodide.

In addition to the spatial association of elevated Hg with the tannery site, it is noted that mercury concentrations in the sediment of both ponds are strongly correlated with chromium concentrations (Fig. 5-20). Because most of the chromium present in the ponds system unequivocally originates at the former tannery, its association with mercury is strongly suggestive of an identical source.

Plow Shop Pond exhibits mercury that is distributed quite ubiquitously (Fig. 5-24). The pond is downstream of the tannery site via a culvert under the railroad causeway. The geometric mean concentration of Hg in shallow sediment is higher (~7 mg/kg) in Plow Shop Pond than in Grove Pond (~4 mg/kg), and there are few non-detects in the database. Thus, it is apparent that, once Hg was released to the environment from the tannery site, transport processes acted to distribute it relatively uniformly across Plow Shop Pond. This is a somewhat unexpected result, as familiar transport processes for metals might be expected to show a "swath" of elevated Hg from the culvert to the outlet in the northwest cove. If, for example, Hg were sorbed onto clastic particles (e.g., on ferric oxyhydroxide grain coatings), its downstream distribution would be controlled by sediment transport processes. However, it is difficult to reconcile the ubiquitous Hg in Plow Shop Pond with expected patterns of clastic sediment transport, particularly given that the pond is a very low-energy environment. For this reason, it is speculated that organic matter in the ponds may have played a significant role in enhancing the mobility of mercury.

Although Hg has received a great deal of attention in recent years in New England because of concern for the impact of atmospheric fallout from emissions from coal burning in the Midwest, it appears that the Hg in Grove and Plow Shop Ponds is dominated by one or more other sources. Kamman, et al. (2004) recently surveyed numerous lakes across Vermont and New Hampshire for mercury accumulation. They found total mercury in sediment at concentrations ranging from 0.07 to 0.62 mg/kg, with an arithmetic mean of 0.24 mg/kg, based on 129 samples. These results are about two orders of magnitude lower than the concentrations observed in Grove and Plow Shop Ponds, suggesting that regional atmospheric deposition has contributed only a very small fraction of the Hg observed.

5.7 Lead

5.7.1 Distribution

For comparison to Grove and Plow Shop Pond sediments, the following values are reported from the reference areas, as described above (Sec. 5.1):

Reference Area	Pb Concentration (mg/kg)
Flannagan Pond	200 and 120
Sandy Pond	280
Spectacle Pond*	5.7
Grove Pond*	~8 - 14
Plow Shop Pond*	~1 - 12

*Norton (2001) "background"

5.7.1.1 Grove Pond

The distribution of lead detections in shallow (0-1 ft) sediment samples from Grove Pond is shown in Figure 5-26. Lead detections are ubiquitous across the pond, but the highest detections appear to cluster in the northwestern portion of the pond, known as Tannery Cove. The maximum detection is 1760 mg/kg, in a sample in this area (GRD-95-31X). The second highest detection is also in Tannery Cove, at 1600 mg/kg (GP15). Lead was not detected in only 2 of 142 samples in the database for shallow sediment. The arithmetic mean of the 140 detections is 271 mg/kg; the geometric mean is 133 mg/kg (Fig. 5-27).

Based on a smaller sample set of ten surface grabs, Norton (2001) calculated an arithmetic mean of 249 mg/kg, very close to that computed for the comprehensive dataset discussed in the foregoing.

Lead was detected in the two upstream reference samples from Flannagan Pond at 120 and 200 mg/kg, and in the reference sample from Sandy Pond at 280 mg/kg. Based on this limited comparison, it appears that lead is not greatly elevated overall in shallow Grove Pond sediment relative to the upstream reference ponds. However, a number of samples in the vicinity of Tannery Cove show concentrations above 1000 mg/kg, approximately an order of magnitude higher than the upstream reference values.

Sampling of deep (>1 ft) sediment in Grove Pond is relatively sparse (Figure 5-28), and Pb was detected in 10 of 16 samples. Although there is a suggestion of higher detections in the Tannery Cove area, this conclusion is tentative because of the paucity of samples across the majority of the pond. The arithmetic mean of the ten detections is 122 mg/kg; the geometric mean is 19.3 mg/kg. These central-tendency estimates are strongly influenced by a few high detections in the Tannery Cove area, and are not representative of the pond as a whole. The maximum concentration detected in deep sediment is 150 mg/kg (GRD-95-26X) at a depth of 3 ft. The next highest detection is also in Tannery Cove, 28 mg/kg (GRD-95-27X) at a depth of 5 ft. It is noted that the area off the former tannery site is known to have been subject to filling; "deep" (>1 ft) sediment was likely closer to the sediment – water interface prior to this activity.

There are relatively few samples from >1 ft in Grove Pond, so it is difficult to generalize. However, it is noteworthy that, pond-wide, there are 38% NDs for Pb in the deeper sediment, while the shallow sediment showed only <2% NDs. The very high- concentration samples in the deeper sediment are exclusively in the Tannery Cove area, and are believed to be due to burial of once-surficial sediments by material pushed into the pond during historical filling operations in the cove. (The high Pb is accompanied by high Cr, which is believed to be an unequivocal indicator of tannery impact.)

5.7.1.2 Plow Shop Pond

The distribution of lead detections in shallow (0-1 ft) sediment samples from Plow Shop Pond is shown in Figure 5-29. Lead detections are ubiquitous across the pond, although there appears to be a cluster of more elevated concentrations in the vicinity of the former Railroad Roundhouse on the southeast shore. The maximum detection is 1210 mg/kg, in a sample in this area (RHD-94-02X). (Note that the Figure 5-29 displays a concentration of 1214 mg/kg at a location that falls on shore northeast of the outlet cove in the northwest portion of the pond. This point is deemed suspect, and is not included in the summary statistics discussed here.) The second highest detection is also immediately offshore from the former Railroad Roundhouse, at 1000 mg/kg (SHD-94-09X). Lead was not detected in only 9 of 108 samples in the database for shallow sediment. The arithmetic mean of the 99 detections is 188 mg/kg; the geometric mean is 101 mg/kg (Fig. 5-27).

Based on a smaller sample set of ten surface grabs, Norton (2001) calculated an arithmetic mean of 229 mg/kg, about 22% higher than the mean computed for the larger data set considered in the foregoing.

Lead was detected in the two upstream reference samples from Flannagan Pond at 120 and 200 mg/kg, and in the reference sample from Sandy Pond at 280 mg/kg. Based on this limited comparison, it appears that lead is not greatly elevated overall in shallow Plow Shop Pond sediment relative to the upstream reference ponds. However, a number of samples in the vicinity of the former Railroad Roundhouse show concentrations of the order of 1000 mg/kg, significantly higher than the upstream reference values.

Sampling of deep (>1 ft) sediment in Plow Shop Pond (Fig. 5-30) is much more extensive than that in Grove Pond (Figure 5-n). Lead was detected in 66 of 79 samples. Concentrations overall are significantly lower than those detected in shallow Plow Shop Pond (0-1 ft) sediment. The bubble map suggests that Pb concentrations in deep sediment tend to be higher along the western shore of the pond, similar to the observations made for cadmium (Sec. 5.4.3) and chromium (Sec. 5.5.3). The arithmetic mean of the 66 detections is 33.2 mg/kg; the geometric mean is 11.4 mg/kg. The maximum concentration detected in deep sediment is 260 mg/kg, near the mouth of the outlet cove in the northwest portion of the pond (PSPC15).

5.7.2 Transport Processes

Lead occurs as Pb^{2+} and in a variety of Pb(II) solids (e.g., PbO, $PbCO_3$, $PbCl_2$, $PbSO_4$, PbS). Like other metal cations, lead sorbs onto oxyhydroxides of Fe, Al, and Mn. This gives lead a strong affinity for solid particulates, and limits its mobility in solution. In an aqueous environment, lead will eventually precipitate as an oxide or a sulfide, depending upon local redox conditions. Lead can also be biomethylated, increasing its mobility and volatility.

5.7.3 Conceptual Model

Lead is ubiquitous in shallow (<1 ft) sediment in both Grove and Plow Shop Ponds. Less than 5% of the 250 shallow sediment samples analyzed from the two ponds showed no detectable lead. The geometric mean concentrations for Grove and Plow Shop Ponds are 133 mg/kg and 101 mg/kg, respectively. Detections of the order of 100 mg/kg are scattered widely across both ponds. An area of distinctly higher lead concentrations appears to lie adjacent to the former tannery site in Grove Pond, with several samples showing concentrations greater than 1000 mg/kg. Another area of somewhat elevated Pb is in Plow Shop Pond adjacent to the former Railroad Roundhouse site, where concentrations in several samples are again of the order of 1000 mg/kg.

Deep sediment (>1 ft) in both ponds shows a greater prevalence of non-detects for lead than does shallow sediment, and the arithmetic and geometric means of all lead detections in deep sediment are significantly lower than those for shallow sediment.

Lead has been exploited historically for a number of its physical and chemical properties.
Lead carbonate, or "white lead," sublimed lead, and other lead compounds were at one time widely used paint pigments. It is not known whether or not any historical industries around the ponds (e.g., the Nashoba Mordant and Dye Company) manufactured or handled lead-containing pigments. Note that there is no indication in the spatial distribution of lead detected in sediment that a significant source was or is present in the industrial area on the north shore of Plow Shop Pond. Lead compounds (e.g., Pb-sulfate and Pb-stearate) are used as stabilizers in plastics, particularly those used for electrical insulation. Soluble salts of lead (e.g., nitrates, acetates) have been used as insecticides. Lead arsenate was a widely used pesticide from the late 19^{th} century through the first half of the 20^{th} century. This pesticide was applied heavily in apple orchards, which cover significant acreage within the drainage basin for the ponds. However, due to its relative immobility once adsorbed onto soil particles, there is little evidence that significant quantities of lead were transported from fruit-growing areas to the ponds. Lead anti-knock compounds were added to motor fuels starting in the 1920s, and their use in the United States peaked in the 1970s, when the advent of the catalytic converter and environmental concerns for lead emissions resulted in their phase-out. During the period of leaded gasoline use, large quantities of lead were released to the atmosphere in vehicle exhaust, spread widely by air circulation, and ultimately deposited to soil and surface water. Particulates washed into surface water through soil erosion and storm water runoff added further to lead accumulation in sediment.

The ubiquitous concentrations of lead of the order of 100 mg/kg found across both Grove and Plow Shop Ponds can likely be ascribed to atmospheric deposition and deposition from stormwater runoff from developed areas. Analyses on three samples collected from the upstream reference ponds, which were not subject to the industrial activities prevalent around Grove and Plow Shop Ponds, yielded concentrations in the same range as the arithmetic and geometric means for shallow sediment from the latter, 100 to 300 mg/kg. Elevated Pb at concentrations of the order of 1000 mg/kg in the vicinity of the former tannery site suggests that lead arsenate pesticides likely were used in historic tannery operations. This is further supported by the association of the high lead concentrations in this area with correspondingly high arsenic (presumably from the pesticide compounds) and chromium (believed to be a reliable "tracer" for tannery impacts). Elevated lead, again at concentrations of the order of 1000 mg/kg, found adjacent to the former Railroad Roundhouse site may be derived from babbitt, a Pb alloy used to manufacture journal bearings for railroad cars. Babbitt formulated for this application is typically composed of lead, antimony, tin, and copper. Speculation that babbitt was handled on the site is supported by results from the Railroad Roundhouse Supplemental Site Investigation that found elevated levels of Sb (maximum 1400 mg/kg), Cu (maximum 6900 mg/kg), Pb (maximum 7100 mg/kg), and Sn (maximum 140 mg/kg) in onshore soil, interpreted to be "maintenance by-products" (ABB, 1995). Because antimony and tin are not on the standard Target Analyte List for sediment, correlations between sediment Pb and Sb or Sn cannot be sought to test this hypothesis. However, a strong correlation between Cu and Pb is found for sediment samples collected in Plow Shop Pond adjacent to the Railroad Roundhouse (Fig. 5-31).

In summary, the majority of the lead detections in shallow (0-1 ft) sediment in both ponds, typically of the order of 100 mg/kg, are likely due to ubiquitous atmospheric deposition and stormwater runoff, with the ultimate source being emissions from leaded fuels. This source has diminished sharply in the past 20 years due to the phase-out of leaded gasoline. Lead is further elevated in the northwest portion of Grove Pond, where concentrations of the order of 1000 mg/kg can likely be ascribed to the waste stream from the historic tannery, which appears to have applied lead arsenate pesticides. Similarly, lead is locally elevated in sediment adjacent to the former Railroad Roundhouse, where maintenance activities yielded metallic debris. Lead was detected in deep (>1 ft) sediment along the southern and western shores of Plow Shop Pond. As noted in the discussions of Cd (Sec. 5.4.3) and Cr (Sec. 5.5.3), this pattern may be a consequence of more rapid sedimentation along these portions of the shoreline due to steep slopes and exposed soils. Under these circumstances, sediment that was shallow (0-1 ft) in the later half of the 20th century may now be categorized as "deep" (>1 ft).

5.8 Manganese

The human-health risk assessment (sec. 6.0; Appendix C) identifies manganese in surface water in Grove Pond as a risk driver (i.e., Hazard Quotient greater than one). Although there has been no suggestion that Mn represents anthropogenic inputs to the ponds, a brief overview of its occurrence in sediment is given here for completeness. The discussion is based on sediment sampling and analyses performed by EPA in 2004 and 2005 only.

5.8.1 Distribution

The following table summarizes sediment analyses for manganse available as reference values (Sec. 5.1) to which to compare results from Grove and Plow Shop Ponds.

Reference Area	**Mn Concentration (mg/kg)**
Flannagan Pond	460 and 690
Sandy Pond	980
Spectacle Pond*	380
Grove Pond*	~220 - 825
Plow Shop Pond*	~290 - 942

*Norton (2001) "background"

Manganese was detected in all EPA 2004/2005 sediment samples. Results for shallow (0-1 ft) Grove Pond sediment range from 70 to 1800 mg/kg, with a geometric mean of 818 mg/kg. Shallow (0-1 ft) Plow Shop Pond results are notably higher, in the range 130 to 34,000 mg/kg, and with a geometric mean of 1410 mg/kg. Deep (>1 ft) Plow Shop Pond sediment exhibits lower Mn concentrations than does the shallow sediment, ranging from 31 to 4500 mg/kg, with a geometric mean of 475 mg/kg. The geometric mean Mn concentrations observed for shallow (0-1 ft) Grove Pond and deep (>1 ft) Plow Shop Pond are comparable to the reference concentrations cited in the above table. The geometric mean for shallow (0-1 ft) Plow Shop Pond sediment (1410 mg/kg) is higher than the reference values.

5.8.2 Transport Processes

Manganese is a commonly occurring element in the earth's crust, with an average concentration of 950 mg/kg (Krauskopf, 1967). In solution, manganese behavior is generally similar to that of iron. Aqueous species contain Mn in the +2, +3, and +4 oxidation states and, like iron, Mn may precipitate as oxide, sulfide, and carbonate solid phases. At pH values between 4 and 9, the range found in most natural waters, Mn requires a higher oxidation potential than Fe to oxidize Mn^{+2} to Mn^{+4}, and the kinetics of abiotic Mn oxidation are generally much slower than for Fe (Stumm and Morgan, 1996).

Although not as toxic as the other elements of interest in this study, manganese may cause unpleasant taste and odor in drinking water, and may clog pipes through formation of scale precipitated by Mn-oxidizing bacteria.

5.8.3 Conceptual Model

The high concentrations of Mn in shallow sediment in Plow Shop Pond are predominantly in the southwestern portion. The maximum detected (34,000 mg/kg) is in Red Cove, and a sequence of near-shore sediment samples collected by EPA along the western margin of the pond shows a systematic decrease in Mn to the north, reaching 240 mg/kg near the outlet weir. This pattern mimics closely the distribution of iron and arsenic concentrations in Plow Shop Pond sediment, suggesting that similar processes control the distribution. It is known that groundwater approaching Red Cove shows relatively high concentrations of manganese. EPA profile sampling of groundwater in two direct-push borings adjacent to Red Cove conducted in July 2004 yielded Mn concentrations in filtered samples from 0.39 to 6.2 mg/L, with an arithmetic mean of 1.8 mg/L (see table, sec. 5.10.3). Dissolved iron in the same samples was also elevated, with a mean concentration of 34 mg/L. ORP reported for these samples falls in a relatively narrow range, from -134 to -78 mV. It is concluded that the relatively high Mn concentrations detected in sediments in the southwestern portion of Plow Shop Pond have accumulated from low-ORP, high-Fe, high-Mn groundwater that discharges to the surface water in this area, in a process similar to that controlling arsenic (cf, Sec. 5.3.3).

5.9 Vanadium

The human-health risk assessment (sec. 6.0; Appendix C) identifies vanadium in fish tissue in Plow Shop Pond and as a risk driver (i.e., Hazard Quotient greater than one). Although there has been no suggestion that this element represents anthropogenic inputs to the ponds, a brief overview of its occurrence in sediment is given here for completeness. The discussion is based on sediment sampling and analyses performed by EPA in 2004 and 2005 only.

5.9.1 Distribution

The following table summarizes sediment analyses for vanadium available as reference values (Sec. 5.1) to which to compare results from Grove and Plow Shop Ponds.

Reference Area	V Concentration (mg/kg)
Flannagan Pond	39 and 21
Sandy Pond	49
Spectacle Pond*	not analyzed
Grove Pond*	not analyzed
Plow Shop Pond*	not analyzed

*Norton (2001) "background"

Vanadium was detected in 17 of 17 shallow (0-1 ft) sediment samples from Grove Pond analyzed by EPA in 2004/2005. Concentrations range from 22 to 140 mg/kg, with a geometric mean of 57.3 mg/kg. Three reference samples collected in upstream Flannagan and Sandy Ponds showed V in the range 21 to 49 mg/kg, indicating no evidence of a source or sources local to Grove Pond. Similarly, vanadium was detected in 15 of 20 shallow sediment samples collected by EPA in Plow Shop Pond, ranging from 7.1 to 80 mg/kg, with a geometric mean of 31.8 mg/kg. Again, the similarities in concentrations detected in the upstream ponds, Grove Pond, and Plow Shop Pond suggest no local inputs. Deep (>1 ft) sediment from Plow Shop Pond exhibited detectable V in 20 of 24 samples, in the range 3.2 to 51 mg/kg, with a geometric mean of 11.2 mg/kg. There are no readily available reference values for V in deep sediment for comparison.

5.9.2 Transport Processes

The aqueous speciation of vanadium is dependent on both pH and ORP. Under oxidizing conditions and at near-neutral pH, the most abundant species are those of V(V), $VO_2(OH)_2^-$ and $H_2VO_4^-$. At lower pH and/or under more reducing conditions, concentrations of other, positively-charged, vanadium species increase and are either approximately equal to, or exceed, those of V(V). These include V(III) as $V(OH)_2^+$, and V(IV) as $VOOH^+$ and VO^{+2}. Because vanadium may be present in sediment pore waters in nearly equal proportions as positively- and negatively-charged species, it may bind to both negatively- and positively-charged sites on hydrous ferric oxide surfaces.

Vanadium is naturally occurring, at an average concentration of 135 mg/kg in the earth's crust (Krauskopf, 1967). This element is used in the production of steel and other metal alloys, and in small amounts in manufacture of plastics, ceramics, and rubber. In addition to V mobilized in the environment by surficial weathering processes, V is also released into the atmosphere by combustion of fuel oil and coal.

5.9.3 Conceptual Model

There are no indications in the limited vanadium data reviewed (i.e., EPA 2004/2005 analyses only) of local sources to the ponds. Observed geometric means are comparable to reference values obtained from upstream ponds not impacted by historical activities surrounding Grove and Plow Shop Ponds. It is likely that most of the vanadium mass found in pond sediment is of natural origin, and is present at concentrations reflecting regional lithologies and long-term geological and geochemical transport processes.

5.10 Groundwater Hydrology

This section addresses briefly the interaction of the ponds with adjacent groundwater. This aspect of the hydrology of the system is of particular importance with respect to arsenic detected in pond sediment, which is interpreted to have accumulated primarily from discharging groundwater (see sec. 5.3.3).
Available data to constrain the groundwater hydrology on the scale of Grove and Plow Shop Ponds and the surrounding watershed are limited. The present discussion is restricted to two portions of the system that have been characterized in greater detail. The first is the area in the vicinity of the Town of Ayer water supply wells on the southeast shore of Grove Pond. This area was studied to evaluate the source of arsenic detected in raw (untreated) water produced at the supply wells (Gannett Fleming, 2002). The second area for which there are extensive hydrological data is the domain west of Plow Shop Pond, in the vicinity of Shepley's Hill Landfill (SHL). Groundwater associated with SHL is characterized periodically under a Long-Term Monitoring Plan (Stone and Webster, 1996), and under the Performance Monitoring Plan for the SHL extraction, treatment, and discharge (ETD) system (CH2MHill, 2005). In addition, EPA collected water-level data for an expanded suite of wells in the SHL area in November 2004. Finally, EPA and Gannett Fleming mapped near-shore shallow sediment temperatures along the southern and western shoreline of Plow Shop Pond in March 2004 and April 2005.

5.10.1 Grove Pond / Town of Ayer Wellfield

A Zone II (i.e., the domain contributing to production under extended drought conditions) delineation was conducted for the Town of Ayer Grove Pond wellfield in 1992 (CDM, 1993).

Water levels were recorded regionally both before and during a pumping test at the supply wells. The interpreted groundwater potential surface indicated flow under ambient conditions (no pumping) converging on the eastern portion of the pond from the south, east, and north. The interpreted water levels under pumping conditions suggested relatively local drawdown, with a significant component of the production coming from induced infiltration from Grove Pond. More detailed characterization of the hydrostratigraphy in the neighborhood of the supply wells (Gannett Fleming, 2002) showed that interaction of the wells with the surface water is inhibited by relatively low-conductivity material overlying the screened interval. For this reason, it was concluded that the capture zone for the supply wells extends farther beneath the pond than inferred in the 1992 Zone II study, and induced infiltration is weak. It is likely that a significant fraction of the deeper groundwater flow that converges on the eastern portion of Grove Pond joins a regional subsurface flow toward the WNW, generally following the surface water drainage from Grove Pond to Plow Shop Pond to Nonacoicus Brook to the Nashua River.

Little is known about groundwater – surface water interaction around the majority of the Grove Pond perimeter. It is likely that shallow groundwater discharges to the pond, particularly in the eastern (upgradient) portion. The areas in proximity to the Ayer and Devens wellfields on the south shore are exceptions. Weak induced recharge was found immediately offshore of the Ayer wells when pumping (Gannett Fleming, 2002), and it is likely that the same occurs adjacent to the Devens Grove Pond wellfield. In the western (downgradient) portion of the pond, it is possible that the surface water recharges groundwater, which generally flows to the west and/or northwest.

5.10.2 Plow Shop Pond

Groundwater elevations have been characterized more extensively adjacent to Plow Shop Pond than for areas surrounding Grove Pond because of monitoring associated with Shepley's Hill Landfill (SHL). The landfill lies to the west and southwest of Plow Shop Pond, and monitoring well coverage is extensive. EPA performed a synoptic round of water-level gauging on November 15, 2004, in a large suite of wells along the western and southwestern shore of the pond, as well as in wells farther to the south, west, and northwest. Figure 5-32 shows an interpreted potential surface based on the data collected from shallow overburden wells. Reference elevations were adopted from CH2MHill's survey of existing and new wells (CH2MHill, 2006). Water levels in three wells (SHP-99-29X, SHM-93-01A, and SHL-10) were referenced to older survey results available through the Army GIS database.

An important feature characterizing the interaction of groundwater with Plow Shop Pond is the point where the 217 ft msl groundwater contour intersects the shore immediately north of the southwestern embayment known as Red Cove. The surface water elevation was not measured at the time of the November 2004 groundwater gauging event. However, a staff gauge was installed subsequently near the outlet dam, and has shown very stable pond elevations in six rounds of data collection in August and September 2005 and in March 2006 (CH2MHill, 2005, 2006). The surface water elevation in these six events varied from 217.0 to 217.2 ft msl, indicating that the weir imposes strong control on the pond level. It is therefore reasonable to assume that the surface elevation of Plow Shop Pond was approximately 217 ft msl at the time of the November 2004 groundwater gauging event. The point at which the 217 ft msl groundwater equipotential intersects the pond shoreline is then interpreted as the "hinge" for the pond. Groundwater levels to the south of this point are higher than the surface water, and groundwater discharges to the pond. Groundwater levels to the north of this point are lower than the pond level, and surface water recharges groundwater. Performance monitoring data for the SHL ETD system (CH2MHill, 2005, 2006) confirm that the hinge was in the vicinity of piezometer N2-P2 in August and September 2005. However, the hinge appears to have shifted somewhat to the north, in the vicinity of SHP-01-37X, in March 2006, perhaps due to seasonally elevated groundwater levels in spring.

Independent evidence for the zone of groundwater discharge to the south and southwest shore of Plow Shop Pond is found in nearshore temperature data. In winter and spring, the surface water is colder than adjacent shallow groundwater. Where relatively warm groundwater discharges to the pond, the sediment temperature is elevated relative to the surface water. On March 8, 2004, Gannett Fleming personnel walked the shore of Plow Shop Pond, observed the distribution of surface ice and open water, and measured sediment temperatures with a thermocouple probe where possible. Most of the pond retained thick ice cover at this time, but intermittent patches of open water up to several feet wide perpendicular to the shore and up to tens of feet long parallel to shore were observed. In the two prominent coves on the south and southwest shore, large areas of water were open. Many of these open patches showed accumulations of reddish orange flocculant, interpreted to be hydrous ferric oxide precipitated from reducing groundwater that discharges to the oxidizing surface water environment.

Figure 5-33 shows temperatures measured at 1 ft depth below the water-sediment interface in March 2004; locations are approximate. Sediment temperatures were recorded in the range 1.8 to 10.3 °C. Temperatures varied systematically near the two coves, increasing from the outer (pondward) opening toward the inner (landward) end. The maximum temperature reached in the southern cove (west of the Railroad Roundhouse site) was 10.3 °C; that in Red Cove was 8.5 °C. This pattern is consistent with the focusing of groundwater discharge due to refraction of flowlines approaching the coves. At locations where the thermocouple probe could be inserted to greater depth, temperatures were consistently higher with depth. In addition, where the temperatures at 1 ft bgs were highest (e.g., at the end of the southern cove), the vertical variation in temperature was smallest. These observations are again consistent with discharge of relatively warm groundwater to the pond, with the warmest sediment temperatures corresponding to loci of maximum advective heat transport. Northward of the northernmost point shown on Figure 5-33, the ice was in contact with the shore, and no patches of open water were observed. This change in conditions north of Red Cove is consistent with the location of the hinge interpreted from the adjacent groundwater levels (Figure 5-32). North of the northernmost observed patch of open water, cold pond water recharges groundwater, and the nearshore surface temperature remains at or below freezing.

EPA collected similar data in April 2005 (Figure 5-34). At that time, the entire pond was free of ice. Temperatures at 1 ft below the water-sediment interface were recorded with the thermocouple probe, and sample locations were recorded with a hand-held GPS unit. Data were recorded along the shoreline from a point north of Red Cove to the outlet weir. The data show a gradient from temperatures around 16 °C north of Red Cove to about 13 °C approaching the outlet. This observation is consistent with increasing recharge by surface water from south to north. The vertical hydraulic gradient increases in magnitude from zero at the hinge to a maximum near the outlet weir, and the flux of cold surface water under winter/spring conditions correspondingly increases from south to north.

5.10.3 Arsenic Flux to Red Cove

The hydraulic data discussed in the foregoing paragraphs indicate that shallow groundwater discharges to Red Cove. Arsenic concentrations are very high in shallow (0-1 ft) sediment in this area, with a maximum observed of 6800 mg/kg. It is of interest to estimate the total arsenic mass flux to Red Cove in groundwater to compare to the observed mass presently sequestered in sediment.

The observed head change from SHP-01-38A (217.5 ft msl) to the pond (217.1 ft msl) on August 1, 2005 (CH2MHill, 2006) was 0.4 ft (0.12 m). The distance from that monitoring well to the pond shore is approximately 50 ft (15 m), giving a horizontal gradient of 0.008. CH2MHill (2006) estimated the hydraulic conductivity of the fine sands in the neighborhood of the extraction wells to be 45 ft/d (14 m/d), the average of two determinations. This is in agreement with the overburden conductivity assigned in a calibrated numerical model by Harding (2003). These values give a groundwater flux ("Darcy velocity") of q = 0.36 ft/d (0.11 m/d).

EPA profiled groundwater chemistry in two direct-push borings flanking Red Cove in July 2004. One boring was sampled from 3 to 23.5 ft bgs, a section 20.5 ft (6.2 m) thick; the second was sampled from 4 to 37 ft bgs, a section 33 ft (10 m) thick. The average overburden thickness profiled was 27 ft (8.2 m). The perimeter of Red Cove is approximately 400 ft (120 m). The cross-sectional area across which overburden groundwater approaches the cove is then A = 11,000 ft^2 (990 m^2). The total volume flow rate to the cove is Q = q x A = 3800 ft^3/d (110 m^3/d = 1.1×10^5 L/d). Twelve groundwater samples were collected across these two sections; the geometric mean (filtered) arsenic concentration detected was $\bar{c}$ = 0.43 mg/L. The total mass flux to the cove is then estimated to be J = Q x $\bar{c}$ = 4.7×10^4 mg/d = 17 kg/yr.
A simple test can be carried out to determine whether or not the foregoing estimate of the total arsenic mass flux to Red Cove reconciles with the concentrations of arsenic observed in sediment. The cove is roughly 100 ft by 200 ft in areal extent, i.e., covering about 2.0×10^4 ft^2 (1.9×10^3 m^2). If most of the arsenic brought to the surface by discharging groundwater

accumulates in the uppermost 1 ft (0.30 m) of sediment, the corresponding volume of sediment is $2.0x10^4$ ft^3 (570 m^3). Assume that the (dry) bulk density of the sediment is 1800 kg/m^3, giving a total sediment mass of $1.0x10^6$ kg. According to the estimate for the total mass flux in the previous paragraph, over a period of 100 years, about 1700 kg of arsenic would be discharged to Red Cove. Averaged over the total shallow (<1 ft) sediment mass, this yields a concentration of 1700 mg/kg, which is typical of the observed concentrations in this area. Analytical results for the twelve shallow sediment samples in Red cove shown in Figure 5-4 show As concentrations ranging from 310 to 6800 mg/kg, with a geometric mean of 1400 mg/kg.

It is emphasized that the foregoing is only an order-of-magnitude argument. It involves numerous assumptions and estimates of many parameters, resulting in considerable uncertainty. Nevertheless, the order-of-magnitude agreement between the estimated arsenic mass available from groundwater and the observed arsenic mass in sediment supports the plausibility of the proposed mechanism of accumulation.

It has been suggested that arsenic mobility is controlled by iron (sec. 5.3.3), in which case it might be expected that iron concentrations in Red Cove sediment and in adjacent groundwater are related in a fashion similar to that discussed in the foregoing paragraphs for arsenic. This can be tested readily by rescaling the calculation. The ratio of the geometric mean Fe concentration to the geometric mean As concentration for the ten (filtered) groundwater samples collected from the EPA direct-push borings is 70 (see table below). Therefore, the expected iron concentration in Red Cove sediment, under the same assumptions made for the arsenic calculation, is 70 x 1700 = 120,000 mg/kg. Observed iron concentrations in eleven Red Cove sediment samples (Fig. 5-4; PS2 was not analyzed for Fe) range from 25,500 to 410,000 mg/kg, with a geometric mean of 130,000 mg/kg. Therefore, the mass of iron present in Red Cove sediment is consistent in an order-of-magnitude sense with the cumulative flux of dissolved iron in discharging groundwater over a time scale of the order of 100 years.

It has also been proposed (sec. 5.8.3) that manganese accumulates in sediment from reducing groundwater that discharges to Red Cove. Again, an order-of-magnitude test is possible by estimating the mass flux of manganese in groundwater to the cove, and comparing to the mass present in shallow sediment. The ratio of geometric mean Mn to geometric mean As from the ten (filtered) direct-push groundwater samples is 3.0 (see table below). The expected manganese concentration in sediment is then 3.0 x 1700 = 5100 mg/kg. For comparison, the observed Mn concentrations in four shallow sediment samples collected in Red Cove by EPA in 2004/2005 (PSP06, PSPC13, PSPC14, and PSPC19) range from 1500 to 34,000 mg/kg, with a geometric mean of 4000 mg/kg. This agreement supports the conclusion that manganese, like iron and arsenic, accumulates in Red Cove sediment from discharging groundwater. The reducing groundwater encounters more oxidizing conditions as it approaches the sediment/water interface, and the iron and manganese precipitate to solid phases.

In principle, a similar test could be made for accumulation of other trace metals, including Cd, Cr, Pb, and V, whose mobility in groundwater also is strongly influenced by iron. This would provide an estimate of possible accumulation from groundwater to compare to sediment concentrations. In the cases of Cd, Cr, and Pb, it is concluded in the foregoing sections that much of the mass present is likely due to anthropogenic inputs from historical activities surrounding the ponds. These conclusions would be supported by a determination that accumulation of Cd, Cr, and Pb from discharging groundwater yields sediment concentrations much lower than observed. In practice, this calculation cannot be carried out, because all analyses for Cd and Pb performed on filtered samples from the direct-push groundwater profiling at Red Cove failed to detect these elements at a detection limit of 0.2 µg/L. Chromium was detected in one of ten filtered samples at 0.52 µg/L, just above the detection limit of 0.5 µg/L. Vanadium was not detected in filtered groundwater samples from the direct-push borings.

Analytical results for groundwater sampled from direct-push borings, Red Cove

interval ft bgs	As unfiltered µg/L	As (F) filtered µg/L	Fe unfiltered µg/L	Fe (F) filtered µg/L	Mn unfiltered µg/L	Mn (F) filtered µg/L
boring RC1						
3-5	260	270	33000	37000	650	740
8-10	650	NA	23000	NA	450	NA
13-15	740	NA	26000	NA	520	NA
18-20	650	690	23000	20000	1000	970
21.5-23.5	580	630	17000	19000	1700	2400
boring RC2						
4-6	130	140	15000	19000	940	1200
9-11	600	650	45000	72000	1400	2200
14-16	370	390	51000	55000	970	660
19-21	270	310	32000	37000	490	540
24-26	330	370	28000	31000	380	390
30-32	550	710	34000	30000	2400	2700
35-37	530	610	21000	16000	5400	6200
arith. mean	470	480	29000	34000	1400	1800
geom. mean	430	430	27000	30000	980	1300

6.0 HUMAN HEALTH RISK ASSESSMENT

A Human Health Risk Assessment (HHRA) has been performed and is included as Appendix C. This section of this ESI report contains a summary of the human health risk assessment for Grove and Plow Shop Ponds. The objective of the HHRA is to provide a quantitative estimate of risk posed to humans potentially exposed to Grove Pond and Plow Shop Pond. To assess potential public health risks, three major aspects of chemical contamination and exposure must be considered: 1) the presence of chemicals with toxic characteristics; 2) the existence of pathways by which human receptors may contact site-related chemicals; and 3) the presence of human receptors. The absence of any of these three aspects would result in an incomplete exposure pathway and an absence of quantifiable risk.

The HHRA consists of five major components: Hazard Identification, Exposure Assessment, Dose-Response Assessment, Risk Characterization and Uncertainty Analysis. Tables 5-1 and 5-2 and Appendix C of the HHRA present summaries of the cancer risks and noncancer hazard indices which exceeded EPA acceptance criteria for each receptor evaluated in the risk assessment. These tables identify the chemicals which are driving the risks and present the hazard indices segregated by target organ. Section 6.0 of the HHRA presents the uncertainties associated with the risk evaluations and presents rationale for consideration in determining the chemicals of concern for this site which may require further evaluation and action.

6.1 Human Health Risk Assessment Conclusions

Grove Pond

The human health risk assessment evaluated risks to four receptors: a recreational adult, recreational child, subsistence angler adult and subsistence angler child. Media considered in the recreational receptor evaluations included sediment, surface water and fish tissue. The only medium used in the evaluation of risks to the subsistence angler receptors was fish tissue. For Grove Pond, the carcinogenic risk threshold of 1E-4 was equaled for the recreational adult and recreational child. This threshold was exceeded for the subsistence angler adult. Carcinogenic risk for the subsistence angler child was found to be between 1E-5 and 1E-4. The non-cancer Hazard Index (HI) risk threshold of one (1) was exceeded for all receptors.

Carcinogenic risk drivers, defined as chemicals with risks in excess of 1E-6, for the recreational receptors included arsenic (surface water and sediment), PAHs (sediment), phthalates (surface water) and PCBs (fish tissue). Noncarcinogenic risk drivers, defined as chemicals with hazard quotients (HQs) in excess of one (1), for the recreational receptors included arsenic (sediment), manganese (surface water), mercury (fish tissue), and PCBs (fish tissue).

Carcinogenic risk drivers for the subsistence angler included PCBs, DDD and DDE. Noncarcinogenic risk drivers included mercury and PCBs.

Risk thresholds from potential exposure to lead found in environmental media were not exceeded for recreational adults or children but were exceeded for the subsistence angler child receptor.

Plow Shop Pond

Human health risk assessment results for Plow Shop Pond were similar to those from Grove Pond. For Plow Shop Pond, the carcinogenic risk threshold of 1E-4 was exceeded for the recreational adult and recreational child. This threshold was equaled for the subsistence angler adult. Carcinogenic risk for the subsistence angler child was found to be between 1E-5 and 1E-4. The non-cancer Hazard Index (HI) risk threshold of one (1) was exceeded for all receptors.

> Carcinogenic risk drivers for the recreational receptors included arsenic (surface water, sediment and fish tissue), PAHs (sediment) and PCBs (fish tissue). Noncarcinogenic risk drivers, defined as chemicals with hazard quotients (HQs) in excess of one (1), for the recreational receptors included arsenic (sediment, surface water), chromium (sediment), and mercury (fish tissue).

Carcinogenic risk drivers for the subsistence angler included arsenic and DDD. Noncarcinogenic risk drivers included mercury and vanadium.

Risk thresholds from potential exposure to lead found in environmental media were not exceeded for recreational adults or children. Lead was not a chemical of potential concern in fish tissue from Plow Shop Pond.

Evaluation of Results

This section compares human health risk results to the findings of the fate and transport/environmental chemistry evaluation performed for this study. Of this risk drivers identified in the human health risk assessment, the metals arsenic, chromium, mercury and lead appear to be related to identifiable sources within Grove and Plow Shop Ponds including area-wide groundwater for arsenic. Vanadium and manganese have not been identified as metals with clear Pond-related sources. Possibly, elevated levels of these metals, and associated risks, occur as a result of mobilization of naturally occurring metals by reduced groundwater that enters the ponds from the direction of Shepley's Hill Landfill or other areas.

Organic constituents identified as risk drivers include PAHs, PCBs and DDT breakdown products. While these chemicals are clearly anthropogenically-related, multiple sources for these chemicals appear applicable. Sources may have included upstream contamination, stormwater runoff, atmospheric deposition as well as contributions from the former tannery and railroad roundhouse located on the shores of these ponds. Currently, it is not possible to clearly attribute the contribution levels of these sources to the concentrations observed. However, it does not appear that groundwater is a contributor of organic constituents to the Ponds.

7.0 ECOLIGICAL RISK ASSESSMENT

A Baseline Ecological Risk Assessment (BERA) has been performed and is included in Appendix D. This section of this ESI report contains a summary of the BERA which was conducted to provide a quantitative estimate of risk posed to ecological receptors potentially exposed to Grove Pond and Plow Shop Pond media. This BERA, which incorporates data from 1991 to 2005 collected through several different investigations in the ponds, was conducted to support the ESI.

The conceptual site model (CSM) for Grove Pond and Plow Shop Pond identifies exposure pathways from chemicals in pond sediment, surface water, and biota to aquatic organisms and semi-aquatic wildlife foraging in the pond. Assessment and measurement endpoints were selected based on the CSM. Assessment endpoints represent the ecological resources in the ponds that are to be protected. Measurement endpoints represent measurable ecological characteristics that are evaluated to determine if the assessment endpoints are met.

The assessment endpoints for the receptor groups in the ponds are as follows:

- Protection of the long-term health of water column invertebrate populations sublethal and lethal acute toxic effects of chemicals in surface water.
- Protection of benthic macroinvertebrate communities from sublethal and lethal acute toxic effects of chemicals in sediments.
- Protection of the long-term health of local fish populations from sublethal and lethal toxic effects of chemicals in surface waters.
- Protection of omnivorous mammals and birds, piscivorous mammals and birds, and insectivorous birds foraging in the pond, to insure that ingestion of chemicals in food items, sediment, and surface water does not have a negative impact on growth, survival, and reproduction.

The measurement endpoints used in this BERA to determine risk are the following:

- Comparison of surface water and sediment concentration data to literature benchmarks protective of aquatic biota.

- Surface water chronic toxicity testing using sensitive freshwater invertebrate and fish species.

- Sediment toxicity testing using sensitive invertebrate species.

- Comparison of aquatic invertebrate and fish tissue residue levels against literature Critical Body Residues (CBRs).

- Food chain modeling to estimate a daily intake for wildlife receptors foraging in the ponds; compared the daily intake with literature toxicity reference values (TRV) to calculate a hazard quotient (HQ).

A Weight of Evidence (WOE) approach was used to interpret the various findings of the risk assessment. A WOE score was given to each measurement endpoint "low-medium" to "high", depending on the strength of the link between the measurement endpoint and its associated assessment endpoint. The WOE score was evaluated along with the estimation of risk for each assessment endpoint in a risk integration step. This risk integration step allowed a determination of the potential for and significance of risk to the various assessment endpoints.

Exposure units are defined in ecological risk assessment to provide an estimate of the area of exposure for a given ecological receptor and to determine how to organize the analytical data. The exposure units for this BERA were 1) Grove Pond, 2) Plow Shop Pond, and 3) Flannagan Pond, the reference site.

The HQ method was used to determine risk for ecological receptors foraging in the ponds. An HQ was calculated for each chemical of potential concern (COPC) by dividing an estimated or measured exposure or dose by a corresponding benchmark or toxicity value. Hazard quotients were determined for benchmarks comparisons, CBR comparisons, and food chain modeling. The HQ method was not used to determine risk in toxicity tests, however, which relied on statistical analyses instead.

Where applicable, potential risk to ecological receptors was determined for the background EU, using the same methods used to determine risk to Grove Pond and Plow Shop Pond receptors. A residual risk (RR) was calculated by dividing the site HQ by the background HQ. If the RR was greater than one, risk for a given COPC could not be attributed to background conditions.

7.1 RISK FINDINGS

The results of the risk characterization are summarized in Table 7-1 (Grove Pond) and Table 7-2 (Plow Shop Pond).

TABLE 7-1 Summary of Ecological Risks for Grove Pond

Target Receptor Group	Measurement Endpoints (Lines of Evidence)								Integrated Risk Interpretation
	Published Benchmarks		Laboratory Toxicity Testing		Tissue Residue Analyses		Food Chain Modeling		
	WOE	Risk	WOE	Risk	WOE	Risk	WOE	Risk	
water column invertebrates	L-M	L	M	N		ND		ND	Low risk; no unacceptable risk.
Fish	L-M	L	M	N	M-H	L		ND	Low risk; no unacceptable risk.
benthic invertebrates	L-M	H	M-H	M	M-H	L		ND	Medium risk; unacceptable risk.
omnivorous mammals		ND		ND		ND	M-H	N	No unacceptable risk
piscivorous mammals		ND		ND		ND	M-H	N	No unacceptable risk.
carnivorous birds		ND		ND		ND	M-H	M	Medium risk
piscivorous birds		ND		ND		ND	M-H	N	No unacceptable risk.
insectivorous birds		ND		ND		ND	M-H	M	Medium risk; Unacceptable risk unlikely.

Shaded cells indicate that the measurement endpoint was not applicable to the assessment endpoint
WOE = weight of evidence
N=No significant risk identified; L-M = low-medium; M-H = medium-high; H = high
ND = not determined

TABLE 7-2 Summary of Ecological Risks for Plow Shop Pond

Target Receptor Group	Measurement Endpoints (Lines of Evidence)								Integrated Risk Interpretation
	Published Benchmarks		Laboratory Toxicity Testing		Tissue Residue Analyses		Food Chain Modeling		
	WOE	Risk	WOE	Risk	WOE	Risk	WOE	Risk	
water column invertebrates	L-M	L	M	N		ND		ND	Low risk; no unacceptable risk.
Fish	L-M	L	M	N	M-H	L		ND	Low risk; no unacceptable risk.
benthic invertebrates	L-M	H	M-H	M	M-H	L		ND	Medium risk; unacceptable risk.
omnivorous mammals		ND		ND		ND	M-H	H	High risk; unacceptable risk
piscivorous mammals		ND		ND		ND	M-H	N	No unacceptable risk.
carnivorous birds		ND		ND		ND	M-H	L	Low risk
piscivorous birds		ND		ND		ND	M-H	M	Medium risk; unacceptable risk unlikely.
insectivorous birds		ND		ND		ND	M-H	M	Medium risk; unacceptable risk unlikely.

Shaded cells indicate that the measurement endpoint was not applicable to the assessment endpoint
WOE = weight of evidence
N=No significant risk identified; L-M = low-medium; M-H = medium-high; H = high
ND = not determined

7.1.1 Water column invertebrate community

Potential risk to water column invertebrates based on each measurement endpoint was determined to be the following:

A. Benchmark comparison: The benchmark comparison measurement endpoint was given low-medium weight because benchmarks do not identify site-specific risk but are generic in nature. The benchmark comparisons for Grove Pond and Plow Shop Pond revealed low potential risk to surface water invertebrates.

B. Toxicity testing: The toxicity testing measurement endpoint was given a medium weight. The results of the toxicity tests with *Ceriodaphnia dubia* revealed no significant toxicity for surface water invertebrates in Grove Pond and Plow Shop Pond.

Integrating these two lines of evidence, it is unlikely that surface water invertebrates in either of the ponds experience unacceptable risk from exposure to COPCs.

7.1.2 Benthic macroinvertebrate community

A. Benchmark comparison: The benchmark comparison measurement endpoint was given low-medium weight because benchmarks do not identify site-specific risk but are generic in nature. The benchmark comparisons revealed high potential risk to benthic invertebrates in Grove Pond and Plow Shop Pond.

B. Toxicity testing: The toxicity testing measurement endpoint was given a medium-high weight. Laboratory toxicity testing of three Grove Pond sediment samples using two benthic invertebrate species resulted in significant growth reductions (but no mortality) in two of the three samples. Testing of 11 Plow Shop Pond sediment samples using the same two species resulted in significant mortality and growth reductions in one sample, and significant growth reductions (but no mortality) in five additional samples.

C. CBR comparison: The CBR comparison measurement endpoint was given a medium-high weight. The results of the CBR comparison suggested low risk to benthic invertebrates from accumulated COPC in Grove Pond and Plow Shop Pond.

Integrating these results, it was concluded that toxicity testing and the CBR comparisons carried greater weight than did the comparisons to sediment benchmarks. Therefore, while benchmark exceedances alone suggested potential high risk to benthic invertebrates in both ponds, subsequent lines of evidence indicated that the exceedances did not equate to high risk. The three lines of evidence suggest that benthic invertebrates in Grove Pond were likely to experience medium risk due to potential growth reduction. Benthic invertebrates in Plow Shop Ponds were

likely to experience medium risk due to reduced survival at one location and reduced growth at several other locations in the pond

7.1.3 Fish community

A. Benchmark comparison: The benchmark comparison measurement endpoint was given low-medium weight because benchmarks do not identify site-specific risk but are generic in nature. The benchmark comparisons for Grove Pond and Plow Shop Pond revealed low potential risk to fish.

B. Toxicity testing: The toxicity testing measurement endpoint was given a medium weight. The results of the toxicity tests with *Pimephales promelas* revealed no significant toxicity for fish in Grove Pond and Plow Shop Pond.

C. CBR comparison: The CBR comparison measurement endpoint was given a medium-high weight. The results for the CBR comparison in six fish species collected from Grove Pond indicated that three metals (copper, lead, and zinc) exceeded their LOAEL level by small margins (highest average HQ [hazard quotient]$_{LOAEL}$ = 2.9 for copper in bullhead). These results suggested the presence of low risk to fish in Grove Pond.

The results for the CBR comparison in four fish species collected from Plow Shop Pond, indicated that only copper exceeded its LOAEL level by a small margin (highest average HQ_{LOAEL} = 2.5 in bullhead). These results also suggested the presence of low risk to fish in Plow Shop Pond.Integrating these three lines of evidence, the fish community in either Grove Pond or Plow Shop Ponds is not likely to be at substantial risk from exposure to COPCs. The low risk identified by the CBR comparisons would not have community-level impacts because all the LOAEL exceedances were low, and both copper and zinc are under physiological control.

7.1.4 Omnivorous mammals

The raccoon was the target receptor representing omnivorous mammals feeding at the Site. Only one LOE was available to assess risk to this receptor group. Food chain modeling was used to calculate COPC-specific total daily doses (TDD) for comparison to mammalian Toxicity Reference Values (TRVs). Most of the COPC concentrations in the food items used in modeling were based on site-specific measurements or estimates. Hence, this LOE was given a medium-to-high weight.

The results of the HQ calculations indicated it unlikely that omnivorous mammals would experience unacceptable risk from foraging in Grove Pond. However, the potential for high risk was identified for omnivorous mammals foraging in Plow Shop Pond, mainly because of the incidental ingestion of arsenic in pond sediments. There was significant uncertainty associated with this finding, as discussed below.

7.1.5 Piscivorous mammals

The mink was the target receptor representing piscivorous mammals feeding at the Site. Only one LOE was available to assess risk to this receptor group. Food chain modeling was used to calculate COPC-specific TDDs for comparison to mammalian TRVs. Most of the COPC concentrations in the food items used in modeling were based on site-specific measurements or estimates. Hence, this LOE was given a medium-to-high weight.

The results of the HQ calculations indicate that it was not likely that piscivorous mammals would experience unacceptable risk from foraging in Grove Pond or Plow Shop Pond.

7.1.6 Carnivorous birds

The black-crowned night heron was the target receptor representing carnivorous birds feeding at the Site. Only one LOE was available to assess risk to this receptor group. Food chain modeling was used to calculate COPC-specific TDDs for comparison to bird TRVs. Most of the COPC concentrations in the food items used in modeling were based on site-specific measurements or estimates. Hence, this LOE was given a medium-to-high weight.

The results of the HQ calculations indicated the potential for medium risk to carnivorous birds foraging in Grove Pond and low risk in Plow Shop Pond, mainly owing to the incidental ingestion of chromium in pond sediments. There was significant uncertainty associated with this finding, as discussed below.

7.1.7 Piscivorous birds

The kingfisher was the target receptor representing piscivorous birds feeding at the Site. Only one LOE was available to assess risk to this receptor group. Food chain modeling was used to calculate COPC-specific TDDs for comparison to bird TRVs. Most of the COPC concentrations in the food items used in modeling were based on site-specific measurements or estimates. Hence, this LOE was given a medium-to-high weight.

The results of the HQ calculations indicated that it was not likely that piscivorous birds foraging in Grove Pond would experience unacceptable risk. However, the potential for medium risk was identified for piscivorous birds foraging in Plow Shop Pond, owing to excessive levels of methyl mercury in fish.

7.1.8 Insectivorous birds

The tree swallow was the target receptor representing insectivorous birds feeding at the Site. Only one LOE was used to assess risk to this receptor group. Food chain modeling was used to calculate COPC-specific TDDs for comparison to bird TRVs. The COPC concentrations used in modeling were based on the analysis of tree swallow stomach contents. Hence, this LOE was given a medium-to-high weight.

The results of the HQ calculations indicated that insectivorous birds foraging in Grove Pond and Plow Shop Pond would likely experience medium risk, mainly because of the presence of high chromium levels in stomach contents.

7.2 MAJOR UNCERTAINTIES

The potential for high risk from sediment ingestion was identified for omnivorous mammals (represented by the raccoon) and carnivorous birds (represented by the black-crowned night heron) foraging in the two Site ponds. Several major uncertainties are associated with these risk estimates.

Firstly, unacceptable risk was identified for the raccoon in Plow Shop Pond because of incidental ingestion of arsenic in sediment. The sediment uptake assumption for the raccoon (9% of the diet) was taken from EPA (1993). Because the value was based on conditions different from those in the ponds, there is uncertainty in the accuracy of this value for Grove Pond and Plow Shop raccoons, or other omnivorous mammals. This uncertainty is particularly important because the unacceptable risk concluded for the raccoon in Plow Shop Pond is due to incidental ingestion of arsenic in sediment. Therefore, the risk assumption relies entirely on the sediment intake assumption for this species.

Similarly, the sediment uptake assumption for the black-crowned night heron (2% of the diet) was based on a best professional judgment. There were no measured values for similar species that could have been used with more confidence; EPA (1993) lists an uptake for other aquatic birds at 2%. This uncertainty is particularly important because the risk concluded for the black-crowned night heron in both ponds is due to incidental ingestion of chromium in sediment. Therefore, the risk assumption relies entirely on the sediment intake assumption for this species. For both the raccoon and the night heron, uncertainty is associated with the sediment ingestion rates for another reason. The estimated sediment uptake percentages are potentially overestimated because of the dense vegetative mat that exists throughout the ponds. Because this mat may act as a barrier between sediment and biota, wildlife receptors may have limited direct exposure to sediment substrate. The incidental ingestion assumptions (e.g., 0.09 for the raccoon and 0.02 for the black-crowned night heron potentially overestimate risk from this pathway.

8.0 SUMMARY AND CONCLUSIONS

8.1 Conceptual Model

The ESI presents a broad overview of each of five key elements that have been identified in this and previous studies as potential concerns from a risk perspective. Data for each of these five elements are presented in Section 5.0 in map view in order to identify qualitatively any spatial patterns that suggest localized sources and/or transport pathways. Maps are presented for each pond, and for two depth intervals: 0-1 ft and >1 ft below the sediment/water interface. In addition, histograms are presented for the log-transformed concentrations of each element for the shallow interval (0-1 ft). These plots give a visual impression of the central tendency (geometric mean) and variability (geometric standard deviation) of each element at the pond-wide scale. Elements that exhibit marked departures from log-normal distributions, as well as wide scatter, are suggestive of releases at one or more point sources, superimposed on the ambient distribution.

A*rsenic.* Arsenic is detected in Grove Pond shallow (0-1 ft) sediment at concentrations typically a few tens to a few hundred mg/kg. The geometric mean is 49.8 mg/kg, which is within the range of available reference concentrations determined for the upstream ponds. Characterization of deeper sediment (>1 ft) is limited, but suggests somewhat lower concentrations overall, with a geometric mean of 25.0 mg/kg. A few samples from the northwest portion of the pond (Tannery Cove) exhibit higher concentrations, of the order of 1000 mg/kg, found in both shallow and deep sediment. It is inferred that the widespread arsenic in Grove Pond sediment has accumulated from discharging groundwater, which is known to exhibit elevated arsenic where reducing conditions prevail. In the vicinity of the former tannery, scattered detections at higher concentrations suggest that there may have been local releases associated with historical activities, possibly use of arsenical pesticides.

Plow Shop Pond also exhibits widespread arsenic detections, typically of the order of a few hundred mg/kg, notably higher than the overall concentrations found in Grove Pond. The geometric mean for shallow sediment (0-1 ft) in Plow Shop Pond is 217 mg/kg. Deep sediment (>1 ft) overall is lower in As, with a geometric mean of 35.0 mg/kg. Arsenic detections in shallow sediment are significantly elevated relative to the mean in the southwest portion of the pond (Red Cove), with a maximum detection of 6800 mg/kg. It is inferred that the preponderance of the arsenic detected in Plow Shop Pond sediment is again the result of accumulation from high-As groundwater. Groundwater approaching Red Cove has been shown to exhibit reducing conditions and high dissolved iron and arsenic. The extent to which Shepley's Hill Landfill is responsible for creating or exacerbating the reducing conditions that mobilize arsenic is unknown. When this groundwater discharges to the pond, and encounters oxidizing conditions near the sediment/water interface, hydrous ferric oxide phases precipitate, and adsorb arsenic. This process is evidenced by the abundant reddish orange floc for which Red Cove is named. Sediment As concentrations decrease to the north, approaching the hinge line, north of which the pond recharges groundwater.

Cadmium. Cadmium is detected in both Grove Pond and Plow Shop Pond shallow (0-1 ft) sediment, typically at concentrations ranging from non-detect to a few tens of mg/kg. The geometric mean concentrations for detections in both ponds are nearly identical, 13.2 mg/kg (Grove Pond) and 13.5 mg/kg (Plow Shop Pond). Analyses on deep samples (>1 ft) revealed very few detections. It is inferred that the widespread Cd in shallow sediment likely accumulated from atmospheric deposition and stormwater runoff. Although there are a few potential industrial users of cadmium adjacent to the ponds, there is no suggestion of a localized source in the spatial distribution of concentration. Scattered detections at higher concentrations may be the result of local releases. The maximum detection across both ponds is an isolated value of 730 mg/kg, adjacent to the railroad causeway at the west end of Grove Pond. This may reflect a local, sporadic source. The higher concentrations along the southern and western shores of Plow Shop Pond may result from erosion and deposition of adjacent soils. Clastic sedimentation rates may be higher in this area because of the relatively steep topography and bare ground on the shore. The detection of Cd in the deep (>1 ft) sediment in the same area is consistent with this scenario.

Chromium. Chromium exhibits a very wide range of concentrations in shallow (0-1 ft) sediment in Grove Pond, from non-detect to 52,000 mg/kg. Over the majority of the pond, concentrations are typically of the order of tens of mg/kg, while the high values are found in the vicinity of the former tannery in the northwest portion (Tannery Cove). The geometric mean, which is strongly influenced by the very high concentrations in the Tannery Cove area, is 489 mg/kg, significantly higher than the reference values from the upstream ponds (14-27 mg/kg). The spatial association with the former tannery is clear and consistent with the known use of chromium in the tanning process, and historical waste disposal practices. Few samples have been collected from deep (>1 ft) sediment in Grove Pond, so that generalizations with respect to the spatial distribution of Cr are not possible. There are, however, detections of very high Cr in deep sediment in Tannery Cove (maximum 44,000 mg/kg). It is believed that these “deep” sediments were deposited in the 19^{th} and/or 20^{th} centuries, and subsequently buried by rapid sedimentation due to infilling of the cove.

Plow Shop Pond also shows very high levels of chromium in shallow sediment, with a geometric mean of 908 mg/kg, and a maximum detection of 37,800 mg/kg. In contrast to Grove Pond, high chromium detections in Plow Shop Pond are widespread, and show no obvious spatial pattern of accumulation. While it seems apparent that the ultimate source of the majority of the chromium in Plow Shop Pond sediment is the historic tannery, it is not clear what processes have acted to distribute Cr ubiquitously. It is speculated that organic complexation and/or uptake of Cr by aquatic vegetation may have served to spread chromium relatively uniformly across the pond.

Mercury. Mercury is detected in shallow (0-1 ft) sediment across most of Grove Pond at concentrations of the order of a few mg/kg, but is clearly elevated in the northwest portion of the pond (Tannery Cove). The geometric mean concentration is 4.06 mg/kg, and the maximum (Tannery Cove) is 420 mg/kg. There are relatively few samples of the deep (>1 ft) sediment in Grove Pond, but these are consistent with the shallow results; the maximum detection is 150 mg/kg, in Tannery Cove. The clear spatial association with the former tannery implicates that facility as the source of the preponderance of mercury in pond sediment. Although no records of use have been found, mercury salts were used in tanning, and mercury was used commonly as a fungicide, as well.

Mercury concentrations in Plow Shop Pond shallow (0-1 ft) sediment are higher overall than in Grove Pond, with a geometric mean of 7.45 mg/kg. Mercury is widely dispersed in Plow Shop Pond, with no apparent spatial pattern. As discussed for chromium, it is speculated that organic complexation and/or uptake of Hg by aquatic plants may play a role in the apparently high mobility of mercury within Plow Shop Pond. It is interesting to note that the ratio of the geometric mean concentration for 96 detections of Hg in Plow Shop Pond to that for 96 detections in Grove Pond shallow sediment is 1.83, while the ratio of geometric means for 102 detections of Cr in Plow Shop Pond and 135 detections in Grove Pond is 1.86. The similarity in spatial distribution, as well as in the overall partitioning of contaminant mass between the two ponds, is strongly suggestive that the mercury and chromium in the system share the same source (i.e., the historic tannery) and are controlled by similar transport processes.

Lead. Lead is detected ubiquitously in shallow sediment across Grove Pond, with a geometric mean of 133 mg/kg. Relatively few deep sediment samples were collected in Grove Pond, but the limited data suggest significantly lower concentrations in the sediments >1 ft below the sediment/water interface; Pb was detected in this interval in 10 of 16 samples, with a geometric mean of 19.3 mg/kg. Lead was detected in three shallow samples from the upstream reference ponds in the range 120 to 280 mg/kg, similar to the geometric mean for Grove Pond. Widespread lead concentrations of the order of 100 mg/kg are inferred to result from atmospheric deposition and stormwater runoff, ultimately tracing back to historic vehicle emissions in the era of leaded fuels. A few anomalously high concentrations of lead were detected in the vicinity of Tannery Cove (maximum 1760 mg/kg), and suggest possible use of lead arsenate pesticides at the facility. Note, for example, that the highest lead detection in deep (>1 ft) sediment was found in a sample from Tannery Cove, with Pb at 1000 mg/kg, and accompanied in the same sample by As at 1300 mg/kg and Cr at 44,000 mg/kg. The association with As suggests a possible origin in lead arsenate, and the association with very high Cr seems to implicate the tannery's waste stream. It is noted again that "deep" sediment (>1 ft) in tannery cove likely was surficial sediment in recent decades, but was buried by rapid sedimentation associated with infilling of the cove.

Lead in shallow sediment in Plow Shop Pond is again ubiquitous, with typical concentrations of the order of 100 mg/kg. The geometric mean is 101 mg/kg. Sample coverage for deep sediment in Plow Shop Pond is much more extensive than in Grove

Pond. The geometric mean for 66 detections (out of 79 samples) is 11.4 mg/kg, an order of magnitude lower than in the shallow interval. This is again consistent with the interpretation that the preponderance of lead in Plow Shop Pond originates from atmospheric deposition and stormwater inputs. A few detections of lead at concentrations of the order of 1000 mg/kg were found adjacent to the former Railroad Roundhouse site on the southeast shore. Detection of elevated Pb, Sb, Cu, and Sn in onshore soils at the Roundhouse site are suggestive of a source in babbitt, an alloy used in railroad-car bearings. A strong correlation of Pb and Cu in nearshore sediment samples further supports this interpretation.

8.2 Human Health Risk Assessment

Grove Pond

The human health risk assessment evaluated risks to four receptors: a recreational adult, recreational child, subsistence angler adult and subsistence angler child. Media considered in the recreational receptor evaluations included sediment, surface water and fish tissue. The only medium used in the evaluation of risks to the subsistence angler receptors was fish tissue. For Grove Pond, the carcinogenic risk threshold of 1E-4 was equaled for the recreational adult and recreational child. This threshold was exceeded for the subsistence angler adult. Carcinogenic risk for the subsistence angler child was found to be between 1E-5 and 1E-4. The non-cancer Hazard Index (HI) risk threshold of one (1) was exceeded for all receptors.

Carcinogenic risk drivers, defined as chemicals with risks in excess of 1E-6, for the recreational receptors included arsenic (surface water and sediment), PAHs (sediment), phthalates (surface water) and PCBs (fish tissue). Noncarcinogenic risk drivers, defined as chemicals with hazard quotients (HQs) in excess of one (1), for the recreational receptors included arsenic (sediment), manganese (surface water), mercury (fish tissue), and PCBs (fish tissue).

Carcinogenic risk drivers for the subsistence angler included PCBs, DDD and DDE. Noncarcinogenic risk drivers included mercury and PCBs.

Risk thresholds from potential exposure to lead found in environmental media were not exceeded for recreational adults or children but were exceeded for the subsistence angler child receptor.

Plow Shop Pond

Human health risk assessment results for Plow Shop Pond were similar to those from Grove Pond. For Plow Shop Pond, the carcinogenic risk threshold of 1E-4 was exceeded for the recreational adult and recreational child. This threshold was equaled for the subsistence angler adult. Carcinogenic risk for the subsistence angler child was found to be between 1E-5 and 1E-4. The non-cancer Hazard Index (HI) risk threshold of one (1) was exceeded for all receptors.

Carcinogenic risk drivers for the recreational receptors included arsenic (surface water, sediment and fish tissue), PAHs (sediment) and PCBs (fish tissue). Noncarcinogenic risk drivers, defined as chemicals with hazard quotients (HQs) in excess of one (1), for the recreational receptors included arsenic (sediment, surface water), chromium (sediment), and mercury (fish tissue).

Carcinogenic risk drivers for the subsistence angler included arsenic and DDD. Noncarcinogenic risk drivers included mercury and vanadium.

Risk thresholds from potential exposure to lead found in environmental media were not exceeded for recreational adults or children. Lead was not a chemical of potential concern in fish tissue from Plow Shop Pond.

Evaluation of Results

This section compares human health risk results to the findings of the fate and transport/environmental chemistry evaluation performed for this study. Of this risk drivers identified in the human health risk assessment, the metals arsenic, chromium, mercury and lead appear to be related to identifiable sources within Grove and Plow Shop Ponds including area-wide groundwater for arsenic. Vanadium and manganese have not been identified as metals with clear Pond-related sources. There has been no suggestion that either Mn or V sediment concentrations represent anthropogenic inputs to the ponds. It is concluded that the relatively high Mn concentrations found in the southwestern portion of Plow Shop Pond have accumulated from low-ORP, high-Fe, high-Mn groundwater that discharges to the surface water in this area, in a process similar to that controlling arsenic (cf, Sec. 5.3.3). It is likely that most of the vanadium mass found in pond sediment is of natural origin, and is present at concentrations reflecting regional lithologies and long-term geological and geochemical transport processes. Possibly, elevated levels of these metals, and associated risks, occur as a result of mobilization of naturally occurring metals by reduced groundwater that enters the ponds from the direction of Shepley's Hill Landfill or other areas.

Organic constituents identified as risk drivers include PAHs, PCBs and DDT breakdown products. While these chemicals are clearly anthropogenically-related, multiple sources for these chemicals appear applicable. Sources may have included upstream contamination, stormwater runoff, atmospheric deposition as well as contributions from the former tannery and railroad roundhouse located on the shores of these ponds. Currently, it is not possible to clearly attribute the contribution levels of these sources to the concentrations observed. However, it does not appear that groundwater is a contributor of organic constituents to the Ponds. Relatively few analyses for organics in groundwater surrounding the ponds have been performed. The available data are not sufficient to determine the extent of organic contamination of pond sediments from groundwater.

8.3 Ecological Risk Assessment

The BERA identified unacceptable risk for two receptor groups in Grove Pond and three receptor groups in Plow Shop Pond. The chemicals that were identified as risk drivers are arsenic, chromium, and PAHs.

In Grove Pond, risk to benthic invertebrates was found to be unacceptable based on results of toxicity tests, although no specific risk driver could be identified. Risk to carnivorous birds was also found to be unacceptable in Grove Pond. The risk estimate was driven by the incidental ingestion of chromium in sediment.

In Plow Shop Pond, risk to benthic invertebrates, omnivorous mammals, and carnivorous birds was found to be unacceptable. For benthic invertebrates, unacceptable risk was attributed to PAHs in the vicinity of the Railroad Roundhouse. In other areas (e.g., the western shore), a COC driving toxicity could not be identified with confidence. Risk to omnivorous mammals was attributed primarily to the incidental ingestion of arsenic in sediment. Risk to carnivorous birds was attributed primarily to the incidental ingestion of chromium in sediment. While risk to omnivorous mammals and carnivorous birds was found to be unacceptable, there is significant uncertainty associated with risk determination for both receptor groups. This is primarily because of the uncertainty associated with the amount of sediment that the representative species were assumed to ingest.

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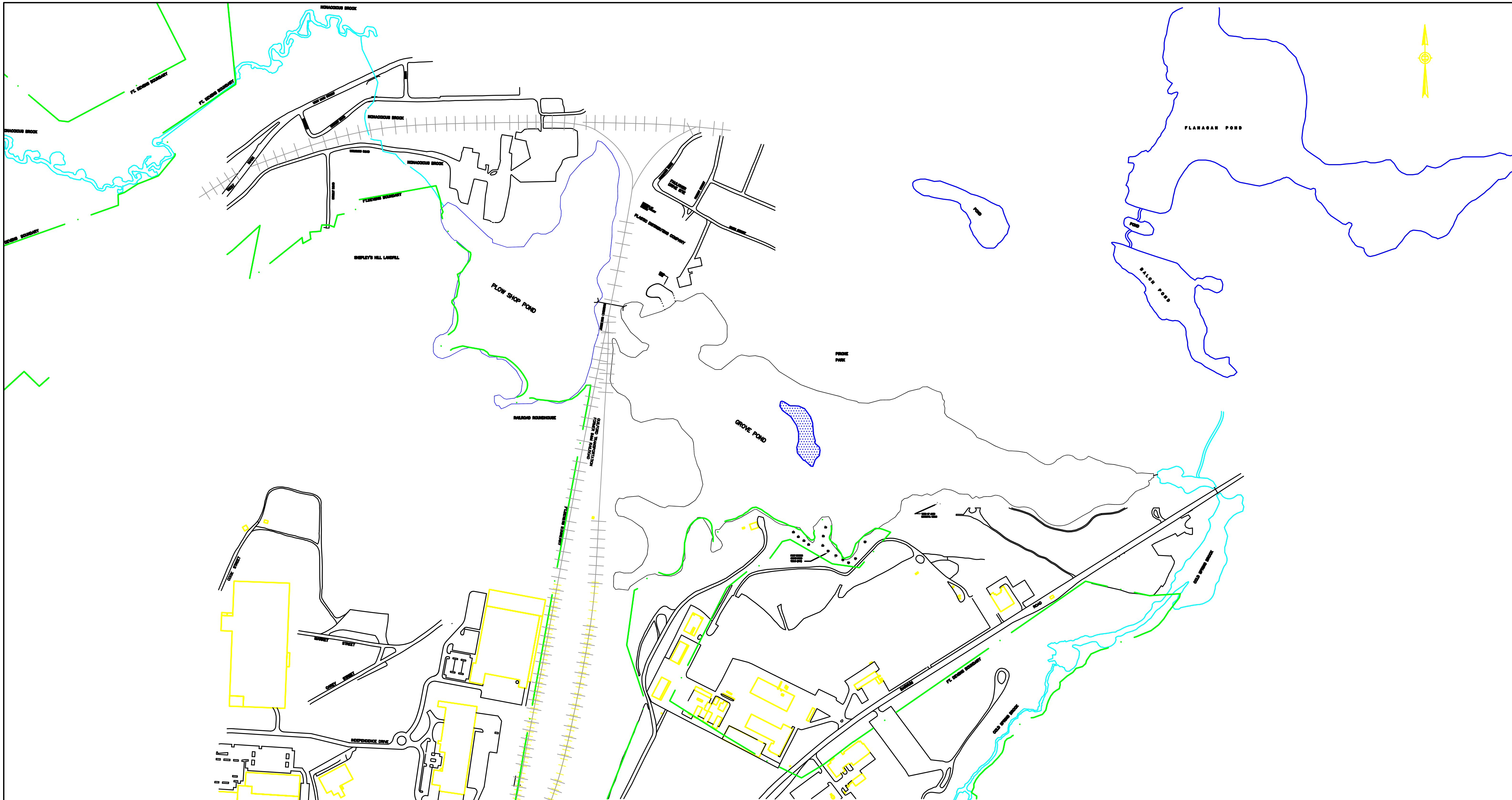
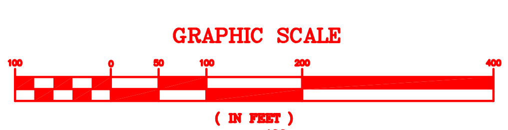
FIGURES





GENERAL NOTES:

1. Base map was originated from the MassGIS database system.
2. Sample locations are approximate only and have not been instrument surveyed by Gannett Fleming, Inc.

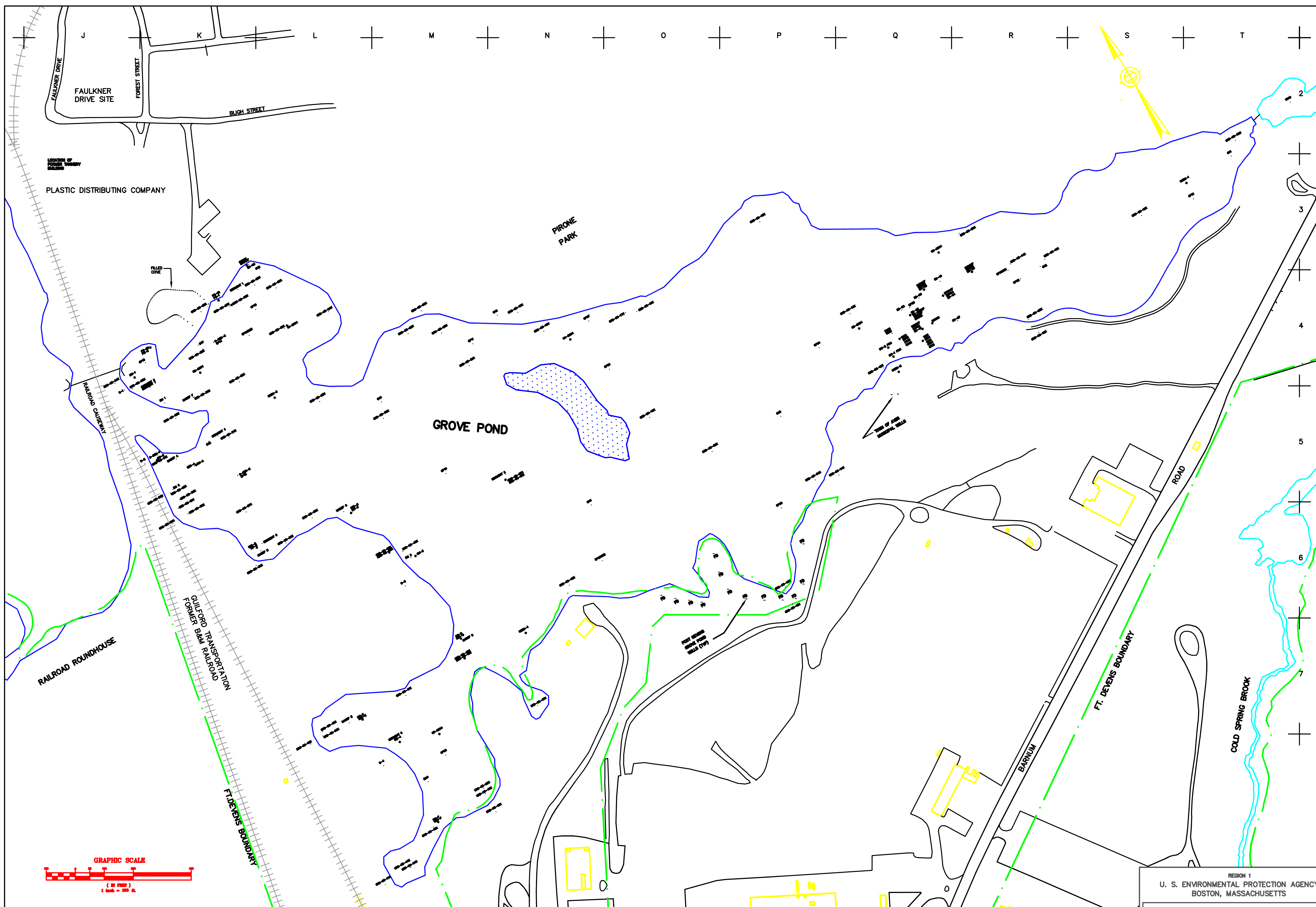
REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

SITE LOCATION MAP

TASK ORDER NO. 1
SCALE: AS SHOWN
FIGURE NO. 2–1

Gannett Fleming



GENERAL NOTES:

1. Base map was originated from the MassGIS database system.
2. Sample locations are approximate only and have not been instrument surveyed by Gannett Fleming, Inc.

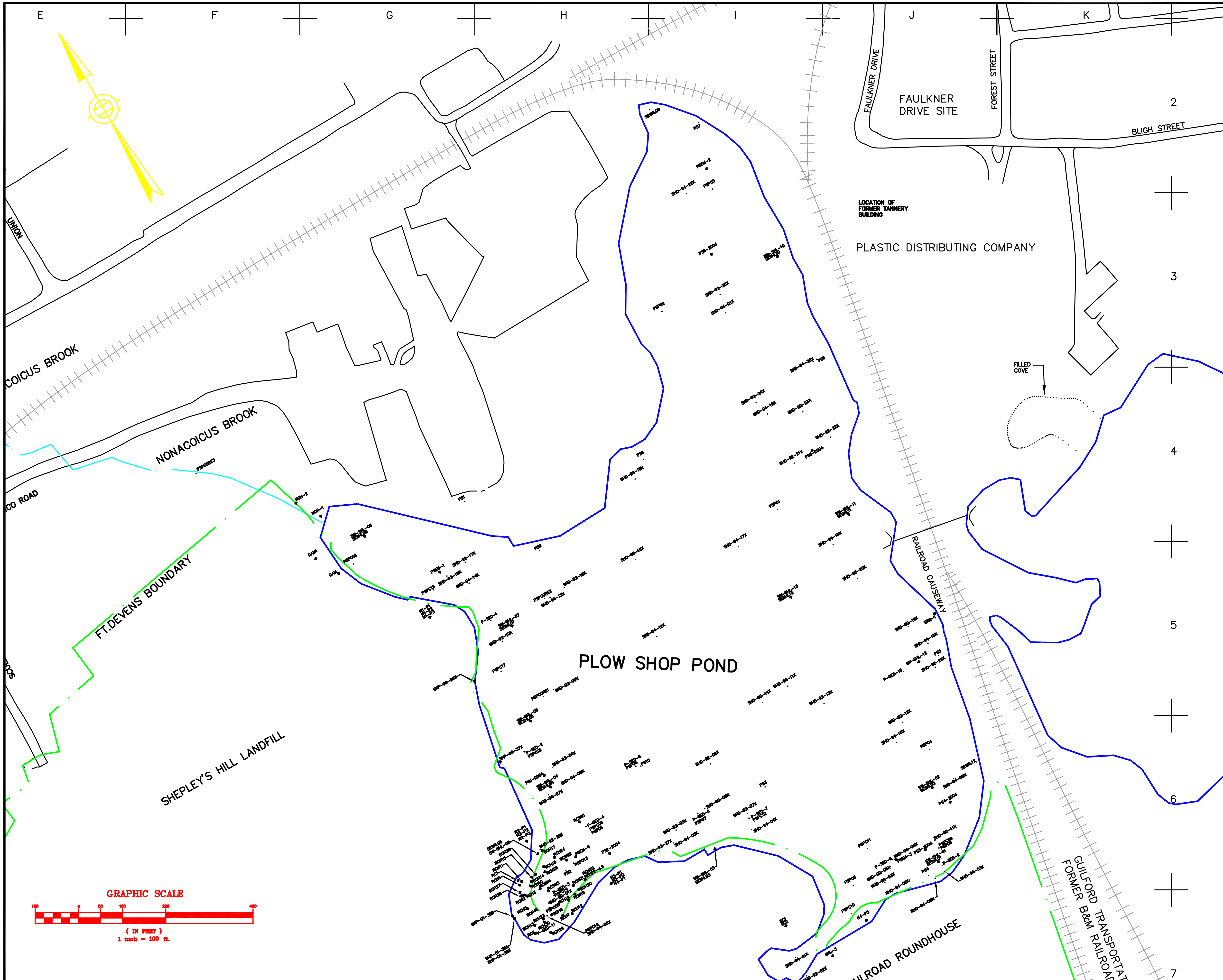
REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

SAMPLE LOCATION PLAN
GROVE POND

DRAWN BY: BT
CONTRACT NO. EP-W-05-020
TASK ORDER NO. 1
SCALE: AS SHOWN
DATE: 05-23-2008
FIGURE NO. 3-1

Gannett Fleming



LEGEND:

SURFACE SOIL SAMPLE

SAMPLE IDENTIFICATION (TYP)

CONCENTRATION IN MG/KG (TYP)
R=CONCENTRATION EXCEEDS RESIDENTIAL PRG
L=CONCENTRATION EXCEEDS LOWER EFFECTS LEVEL
S=CONCENTRATION EXCEEDS SEVERE OR MEDIUM EFFECT

SEDIMENT SAMPLE

PIEZOMETER, WHERE A SOIL SAMPLE WAS COLLECTED

SOIL BORING/TEST PIT GRAB SAMPLE

FT. DEVENS BOUNDARY

SURFACE WATER SAMPLE, WHERE A SEDIMENT SAMPLE WAS COLLECTED

PSEM-1

INTERMEDIATE MONOTORING WELL, WHERE A SOIL SAMPLE WAS COLLECTED

SHL-20

WATER SUPPLY WELLS, ACTIVE OR INACTIVE

GENERAL NOTES:

1. Base map was originated from the MassGIS database system.
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REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

SAMPLE LOCATION PLAN
PLOW SHOP POND

DRAWN BY: BT	CONTRACT NO. EP-W-05-020	SCALE: AS SHOWN	FIGURE NO.
	TASK ORDER NO. 1	DATE: 05-23-2006	3-2

Gannett Fleming

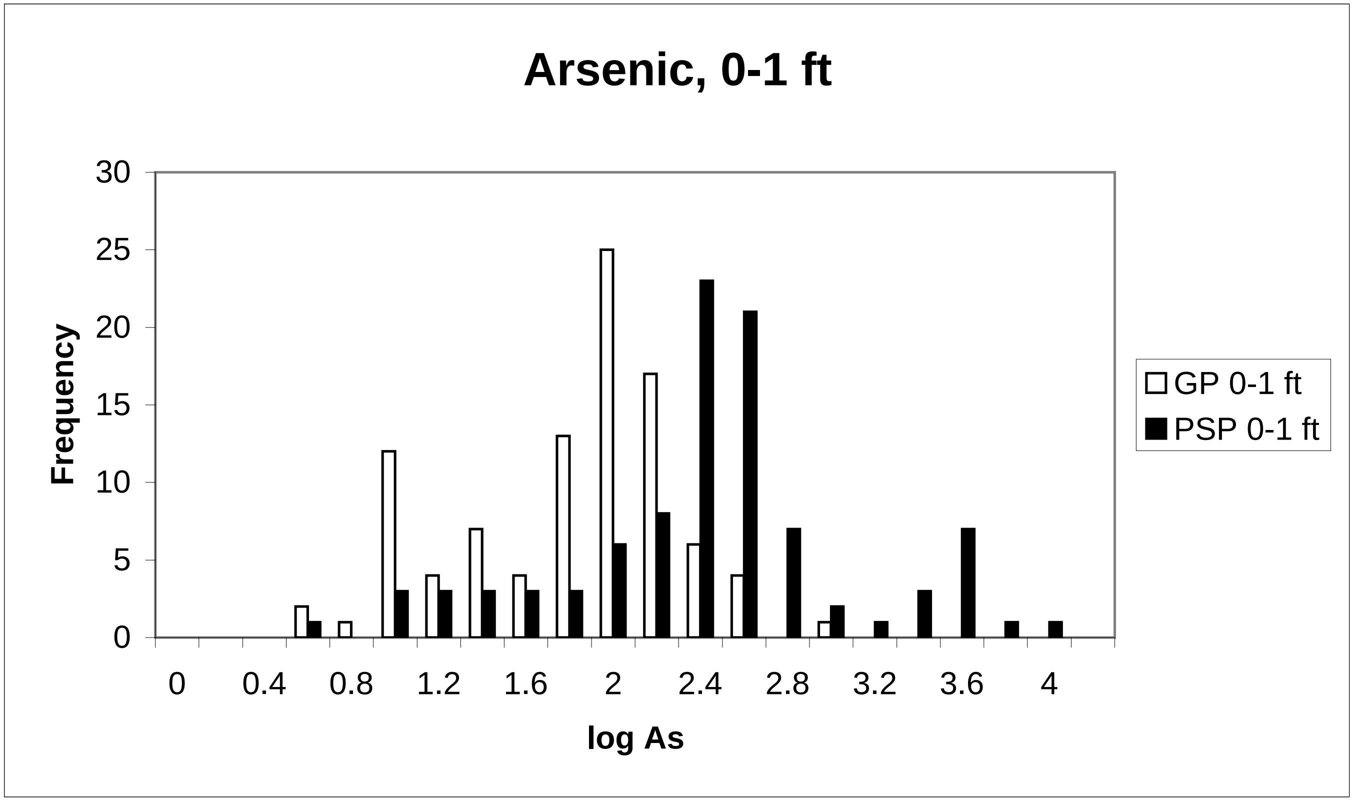


FIGURE NO.: FIGURE 5-1		**REGION 1** **U.S. ENVIRONMENTAL PROTECTION AGENCY** **BOSTON, MASSACHUSETTS**
HISTOGRAMS OF ARSENIC CONCENTRATIONS IN SHALLOW SEDIMENT (0-1 ft.) GROVE AND PLOW SHOP PONDS		**EXPANDED SITE INVESTIGATION** **GROVE AND PLOW SHOP PONDS** **AYER, MASSACHUSETTS**
Contract No.: **EP-W-05-020**	**Task Order No.:** **#1**	

Gannett Fleming

0 50 100 200

Scale: 1 inch = 100 feet

Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to an arsenic concentration of 910 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

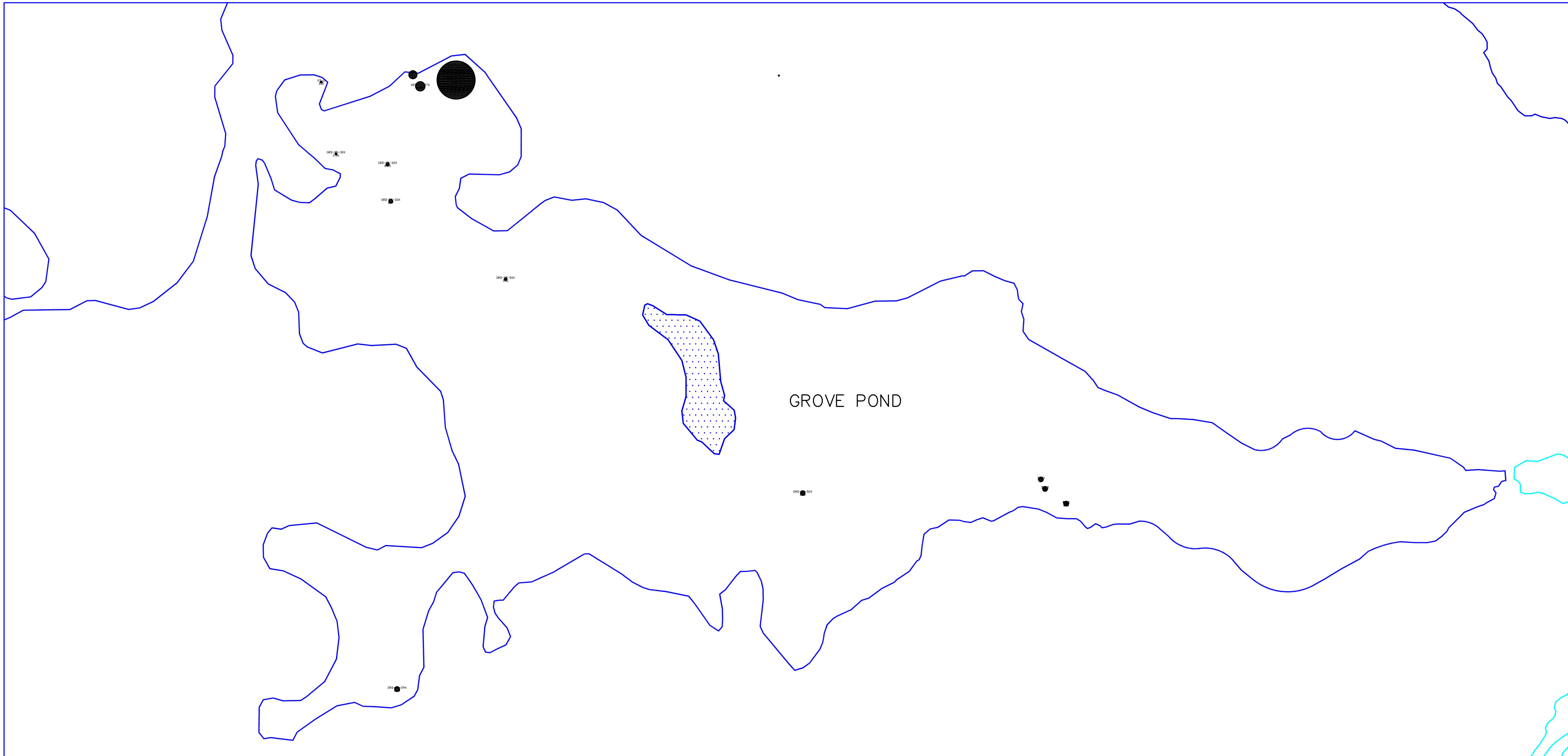
REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

ARSENIC IN SEDIMENT
0 – 1 FOOT BELOW GRADE
GROVE POND

DRAWN BY: JB
CONTRACT NO. EP-W-05-020
TASK ORDER NO. 1
SCALE: AS SHOWN
DATE: DEC, 2005
FIGURE NO. 5-2

Gannett Fleming



0 50 100 200

Scale: 1 inch = 100 feet

Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to an arsenic concentration of 1,300 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

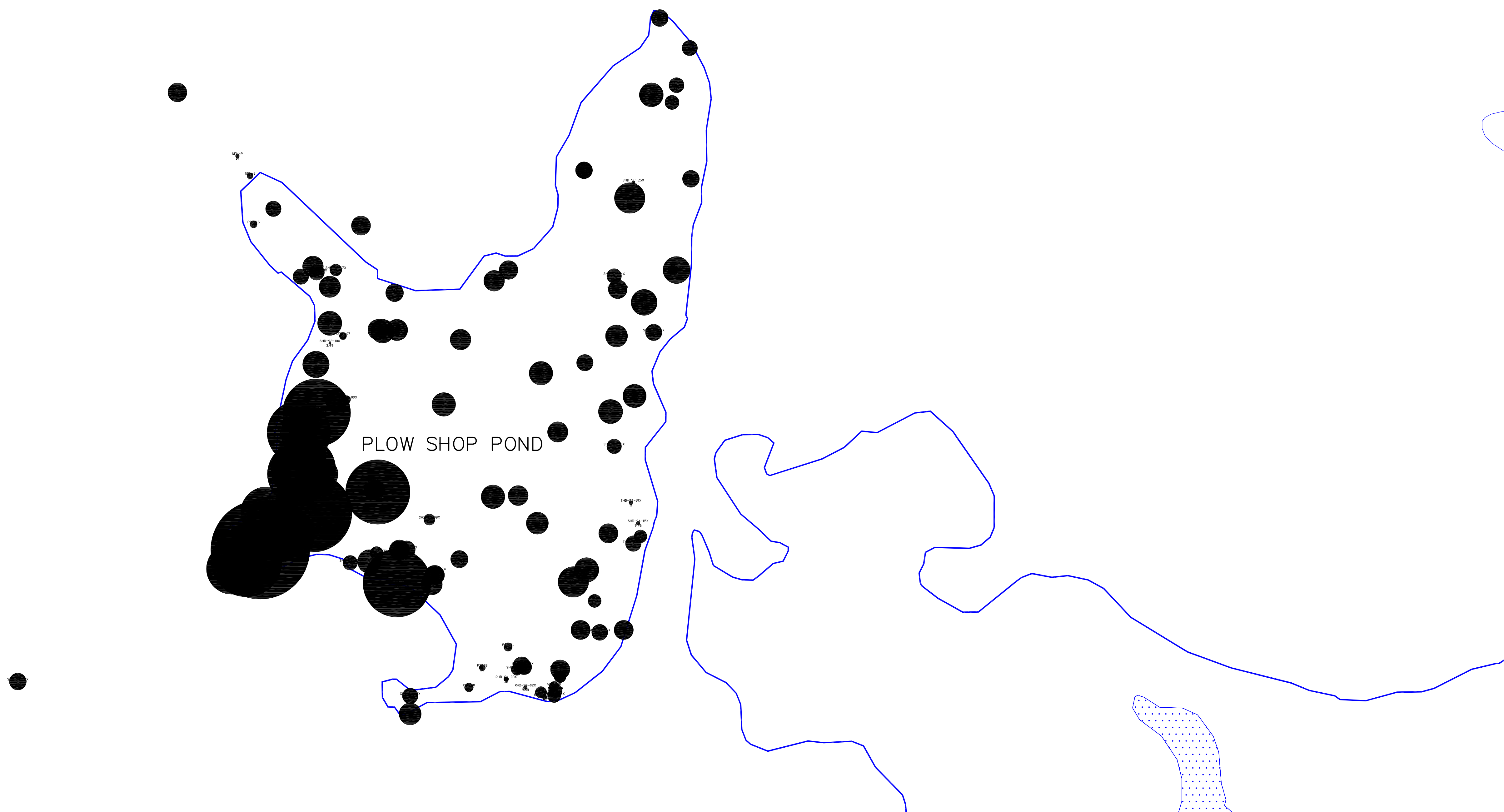
REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

ARSENIC IN SEDIMENT
GREATER THAN ONE FOOT BELOW GRADE
GROVE POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020 / TASK ORDER NO. 1	SCALE: AS SHOWN / DATE: DEC, 2005	FIGURE NO. 5-3

Gannett Fleming



Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to an arsenic concentration of 6,800 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

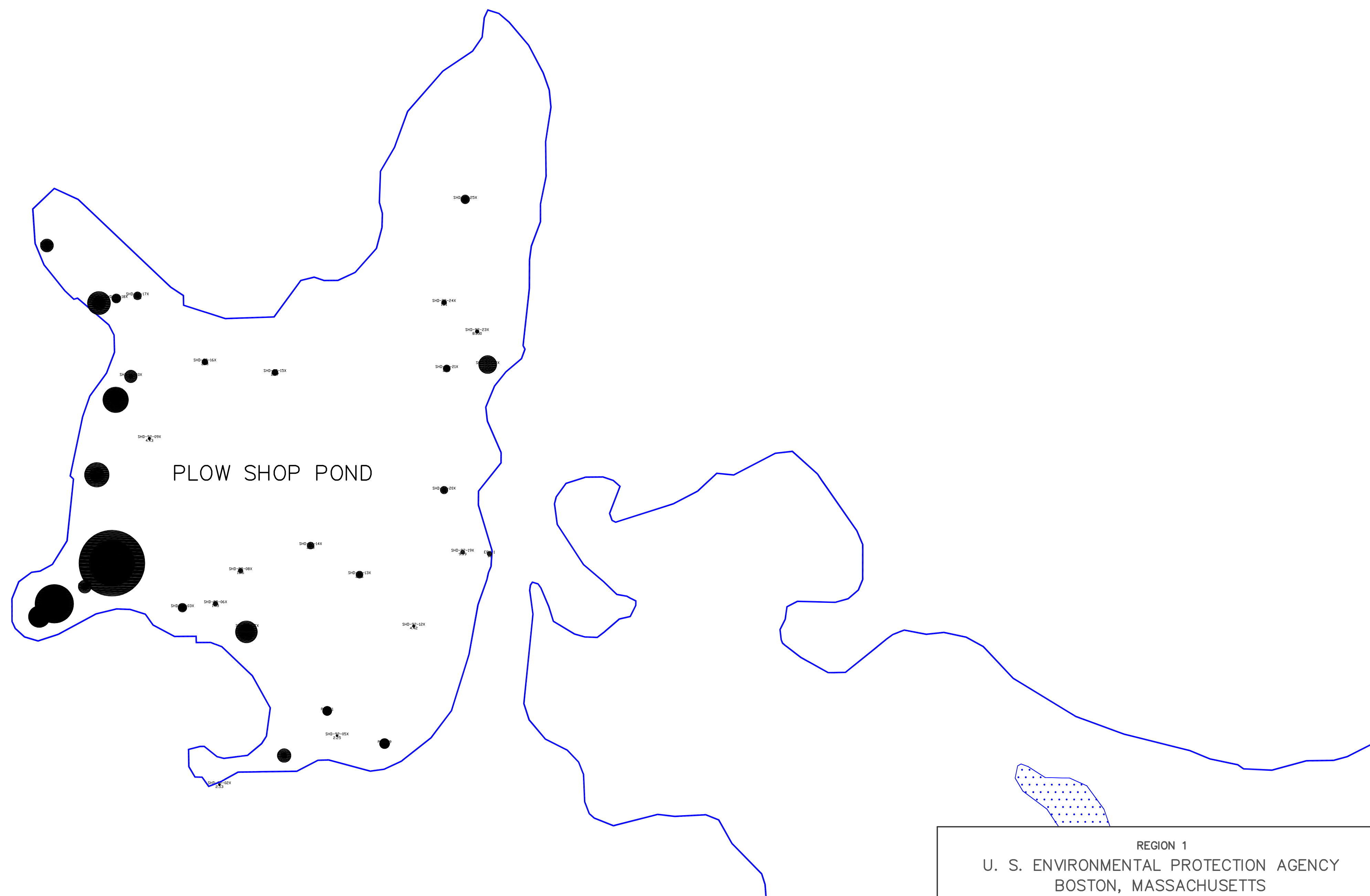
REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

ARSENIC IN SEDIMENT
0 – 1 FOOT BELOW GRADE
PLOW SHOP POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020 / TASK ORDER NO. 1	SCALE: AS SHOWN / DATE: DEC, 2005	FIGURE NO. 5–4

Gannett Fleming



Notes:

1. Base map was originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to an arsenic concentration of 2,500 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

0 50 100 200

Scale: 1 inch = 100 feet

REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

ARSENIC IN SEDIMENT
GREATER THAN ONE FOOT BELOW GRADE
PLOW SHOP POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020	SCALE: AS SHOWN	FIGURE NO.
	TASK ORDER NO. 1	DATE: DEC, 2005	5-5

Gannett Fleming

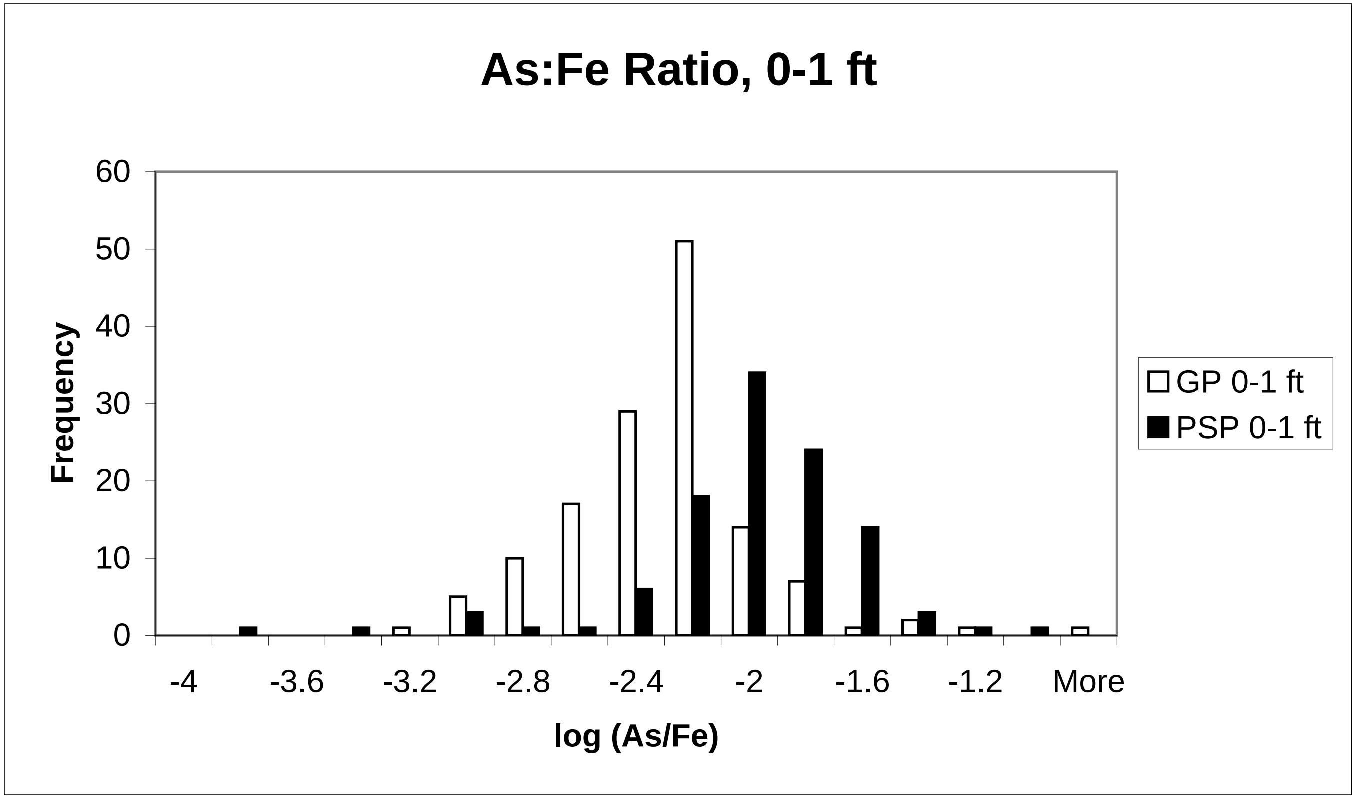


FIGURE NO.: FIGURE 5-6		REGION 1 U.S. ENVIRONMENTAL PROTECTION AGENCY BOSTON, MASSACHUSETTS
ARSENIC AND IRON RATIO 0 -1 FOOT BELOW GRADE GROVE AND PLOW SHOP PONDS		EXPANDED SITE INVESTIGATION GROVE AND PLOW SHOP PONDS AYER, MASSACHUSETTS
Contract No.: EP-W-05-020	Task Order No.: #1	

Gannett Fleming

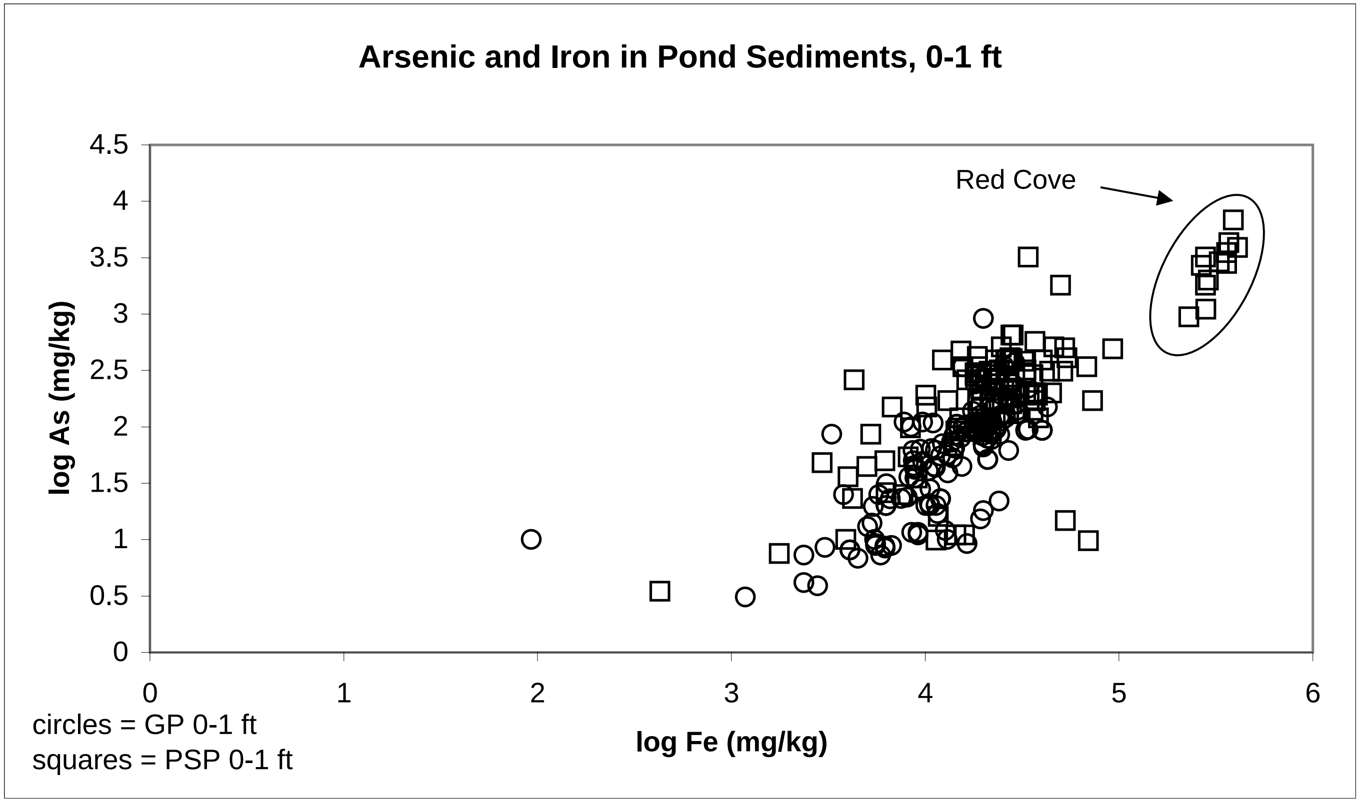
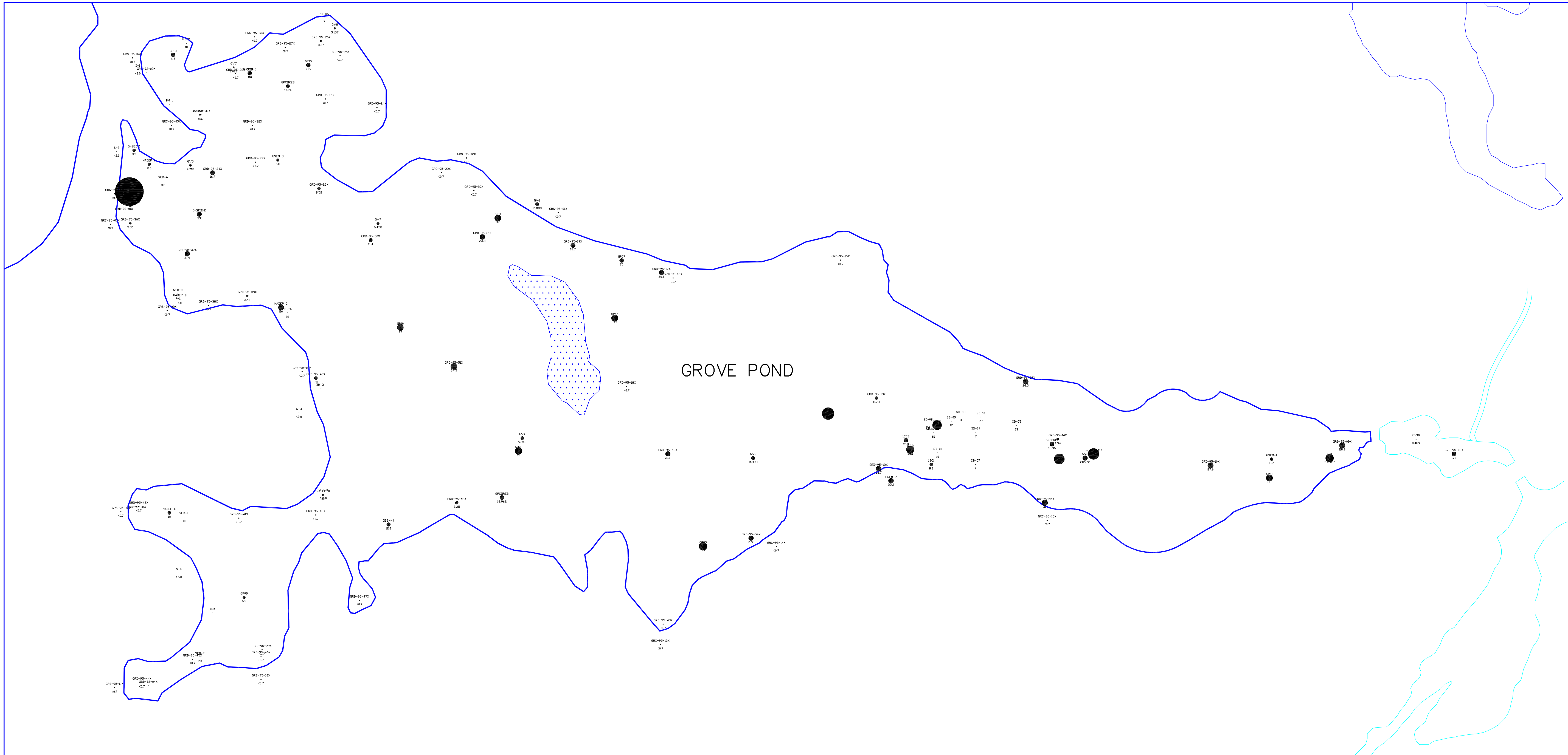


FIGURE NO.: FIGURE 5-7		REGION 1 U.S. ENVIRONMENTAL PROTECTION AGENCY BOSTON, MASSACHUSETTS
ARSENIC vs. IRON IN SHALLOW SEDIMENT 0 -1 FOOT BELOW GRADE GROVE AND PLOW SHOP PONDS		EXPANDED SITE INVESTIGATION GROVE AND PLOW SHOP PONDS AYER, MASSACHUSETTS
Contract No.: EP-W-05-020	Task Order No.: #1	

Gannett Fleming



Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a cadmium concentration of 730 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

0 50 100 200

Scale: 1 inch = 100 feet

REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

CADMIUM IN SEDIMENT
0 – 1 FOOT BELOW GRADE
GROVE POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020 TASK ORDER NO. 1	SCALE: AS SHOWN DATE: DEC, 2005	FIGURE NO. 5–8

Gannett Fleming

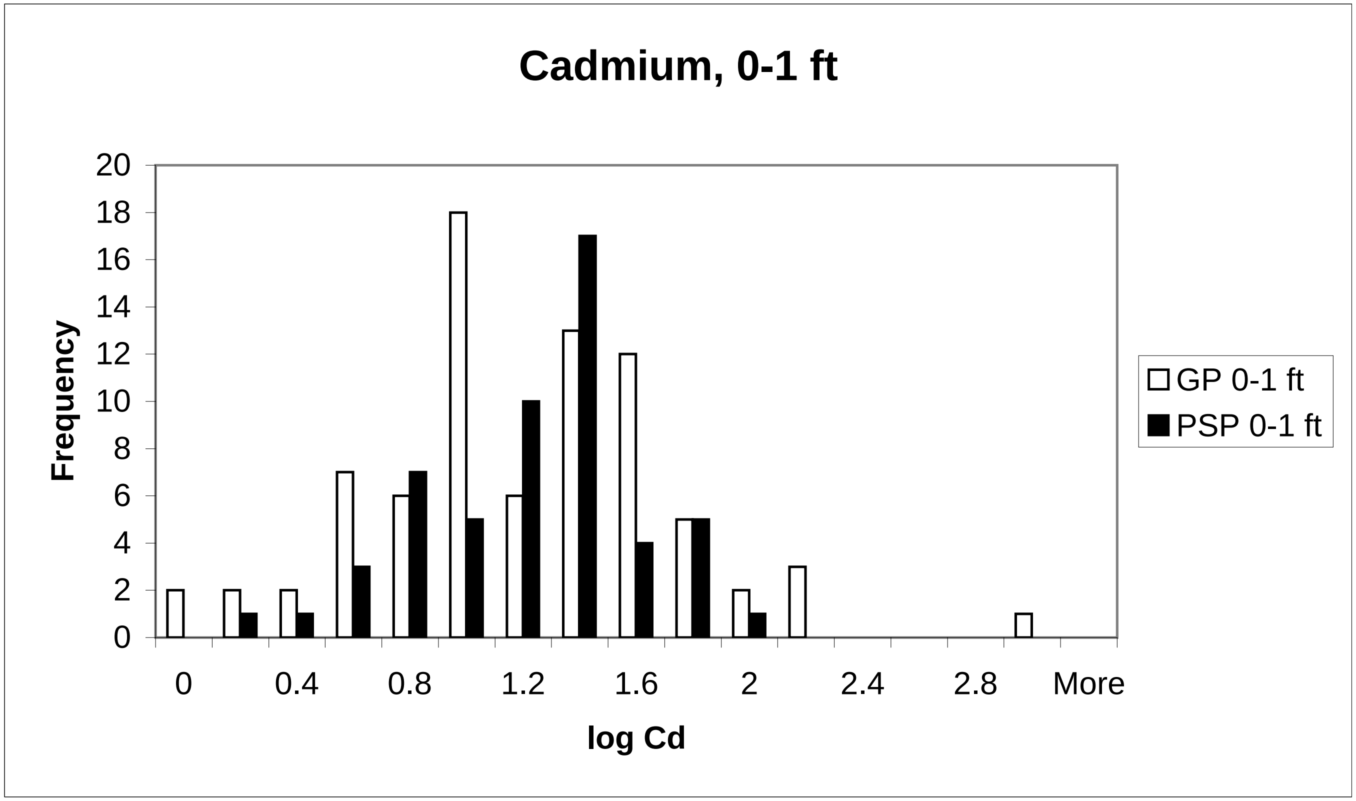


FIGURE NO.: FIGURE 5-9		REGION 1 U.S. ENVIRONMENTAL PROTECTION AGENCY BOSTON, MASSACHUSETTS
HISTOGRAMS OF CADMIUM CONCENTRATIONS IN SHALLOW SEDIMENT (0-1 ft.) GROVE AND PLOW SHOP PONDS		EXPANDED SITE INVESTIGATION GROVE AND PLOW SHOP PONDS AYER, MASSACHUSETTS
Contract No.: EP-W-05-020	Task Order No.: #1	

Gannett Fleming

Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a cadmium concentration of 3.59 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

0 50 100 200

Scale: 1 inch = 100 feet

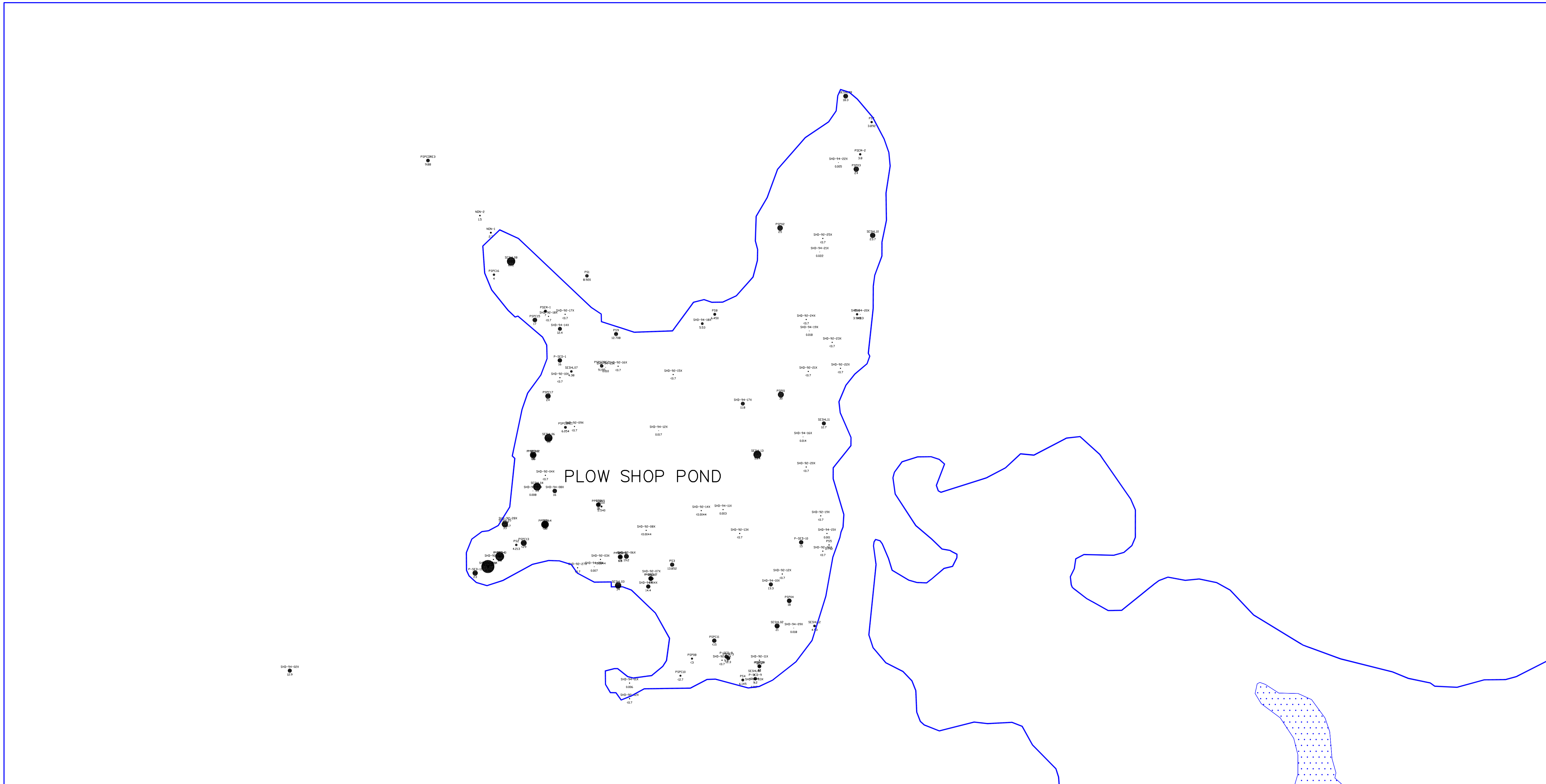
REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

CADMIUM IN SEDIMENT
GREATER THAN ONE FOOT BELOW GRADE
GROVE POND

DRAWN BY: JB	CONTRACT NO. EP–W–05–020 / TASK ORDER NO. 1	SCALE: AS SHOWN / DATE: DEC, 2005	FIGURE NO. 5–10

Gannett Fleming



0 50 100 200

Scale: 1 inch = 100 feet

Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a cadmium concentration of 66 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

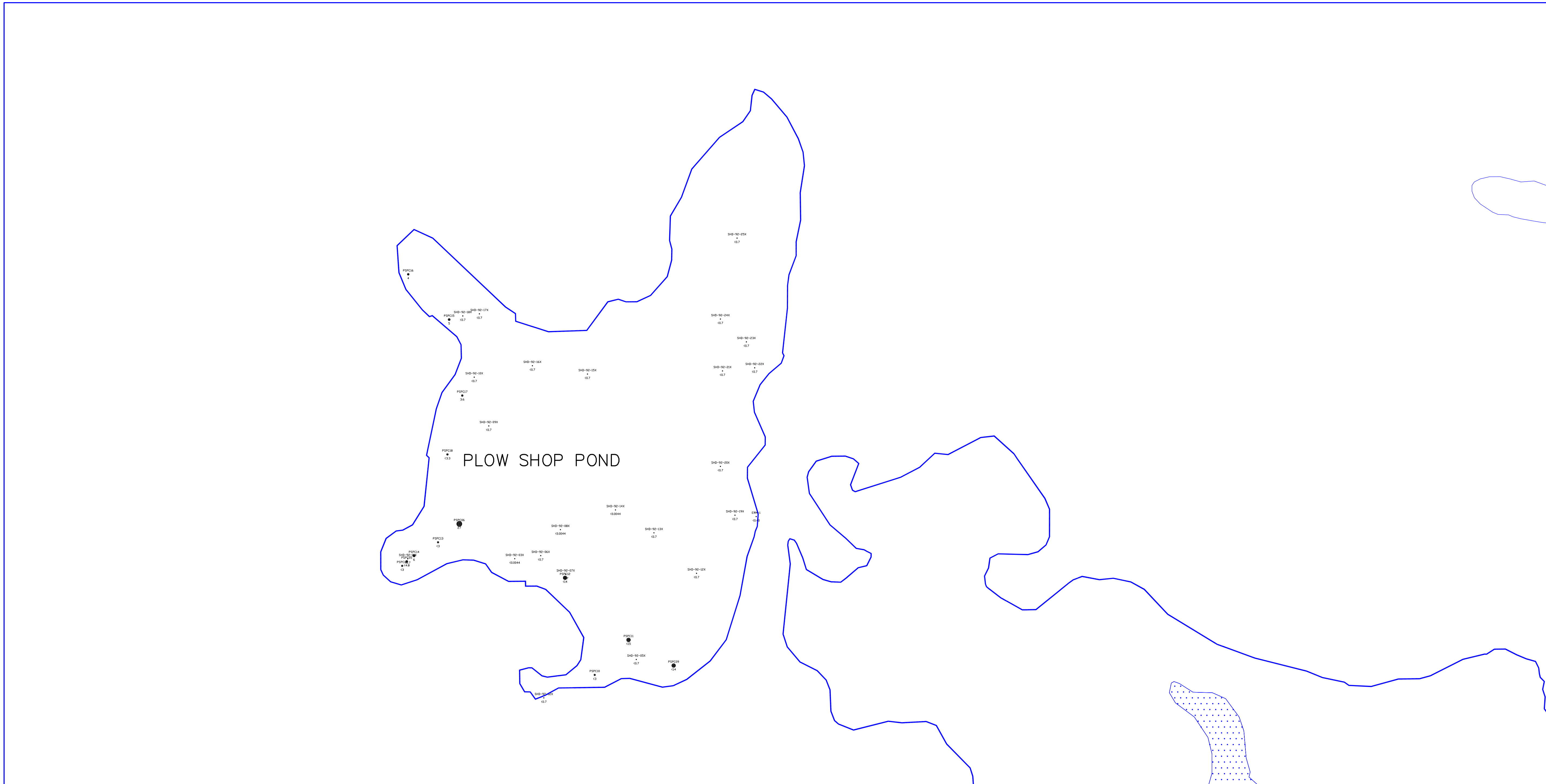
REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

CADMIUM IN SEDIMENT
0 – 1 FOOT BELOW GRADE
PLOW SHOP POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020	SCALE: AS SHOWN	FIGURE NO. 5-11
	TASK ORDER NO. 1	DATE: DEC, 2005	

Gannett Fleming



0 50 100 200

Scale: 1 inch = 100 feet

Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a cadmium concentration of 430 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

CADMIUM IN SEDIMENT
GREATER THAN ONE FOOT BELOW GRADE
PLOW SHOP POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020	SCALE: AS SHOWN	FIGURE NO.
	TASK ORDER NO. 1	DATE: DEC, 2005	5–12

Gannett Fleming

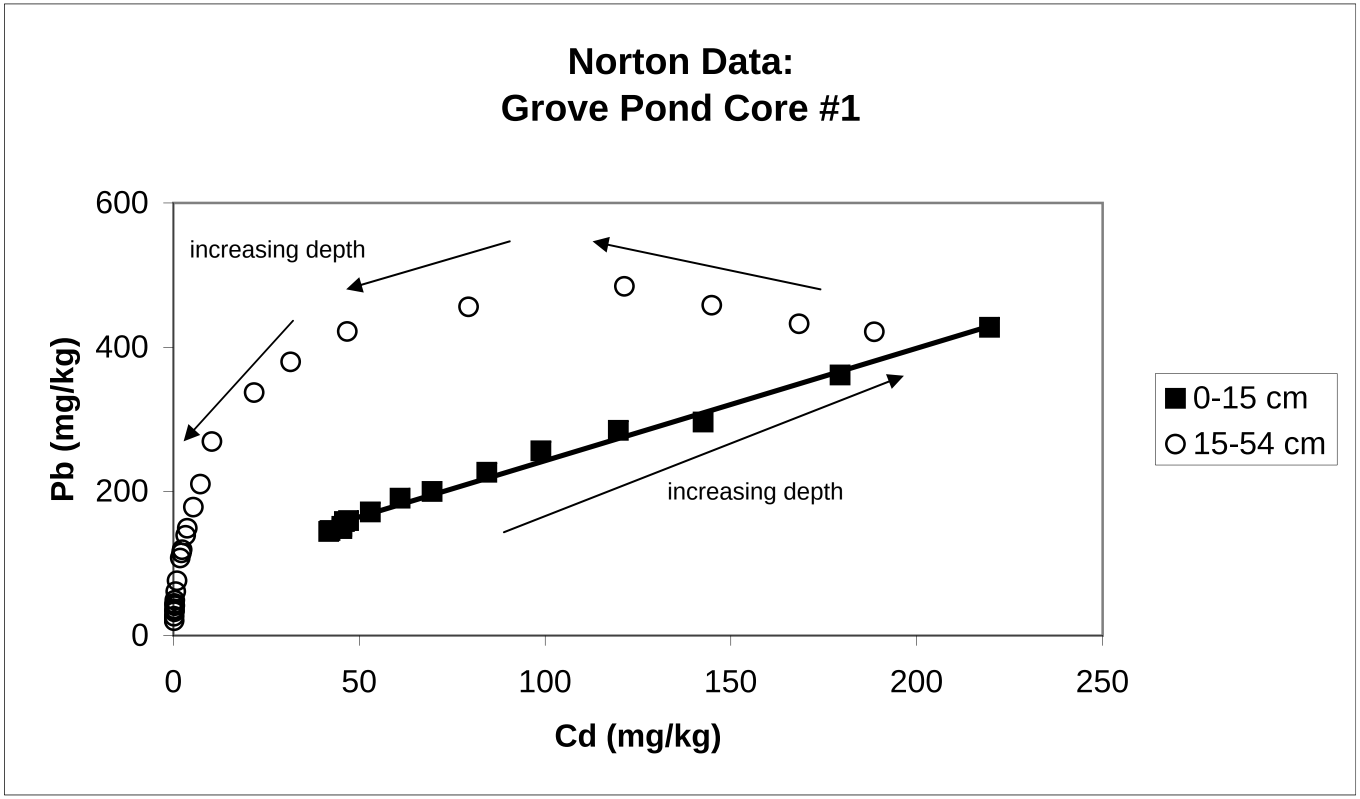


FIGURE NO.: FIGURE 5-13		REGION 1 U.S. ENVIRONMENTAL PROTECTION AGENCY BOSTON, MASSACHUSETTS
CADMIUM vs. LEAD NORTON DATA GROVE POND CORE #1		EXPANDED SITE INVESTIGATION GROVE AND PLOW SHOP PONDS AYER, MASSACHUSETTS
Contract No.: EP-W-05-020	Task Order No.: #1	

Gannett Fleming

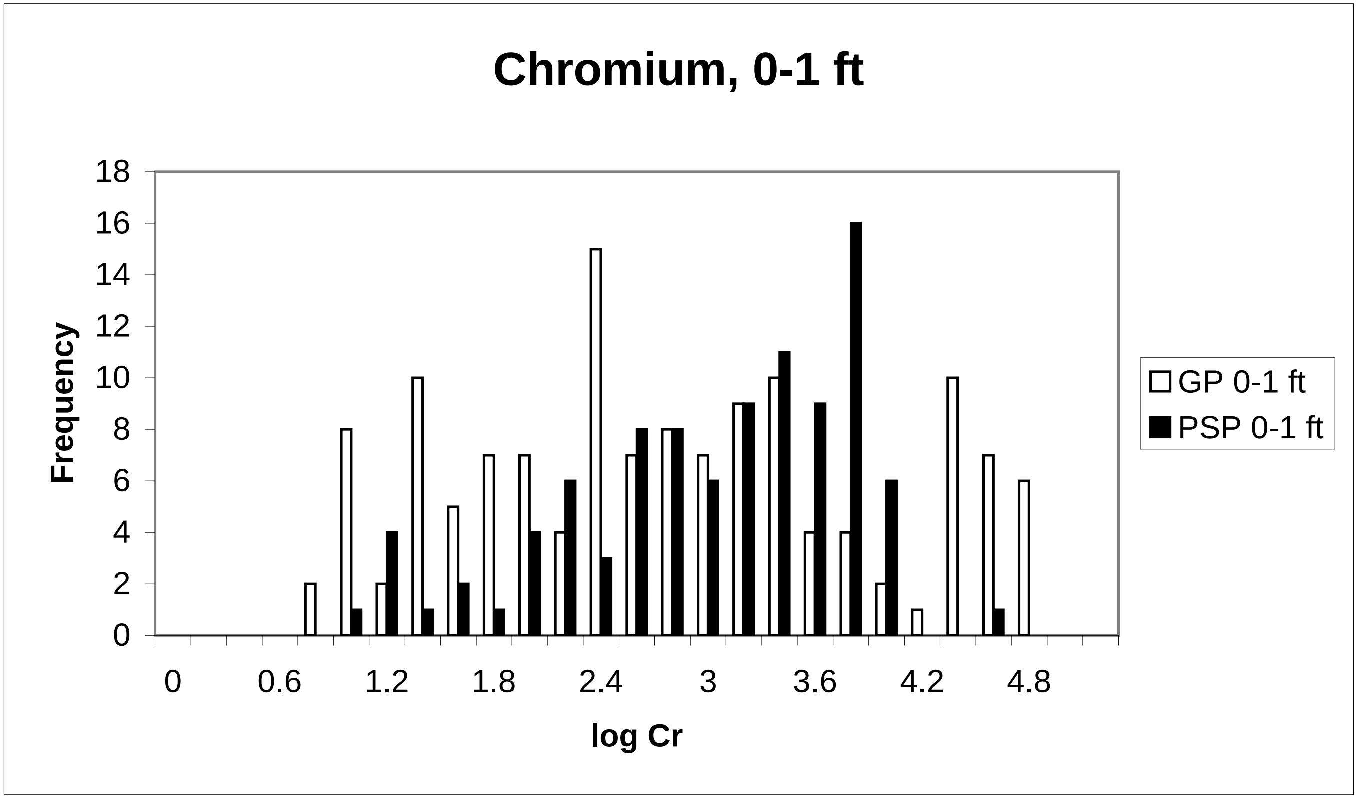
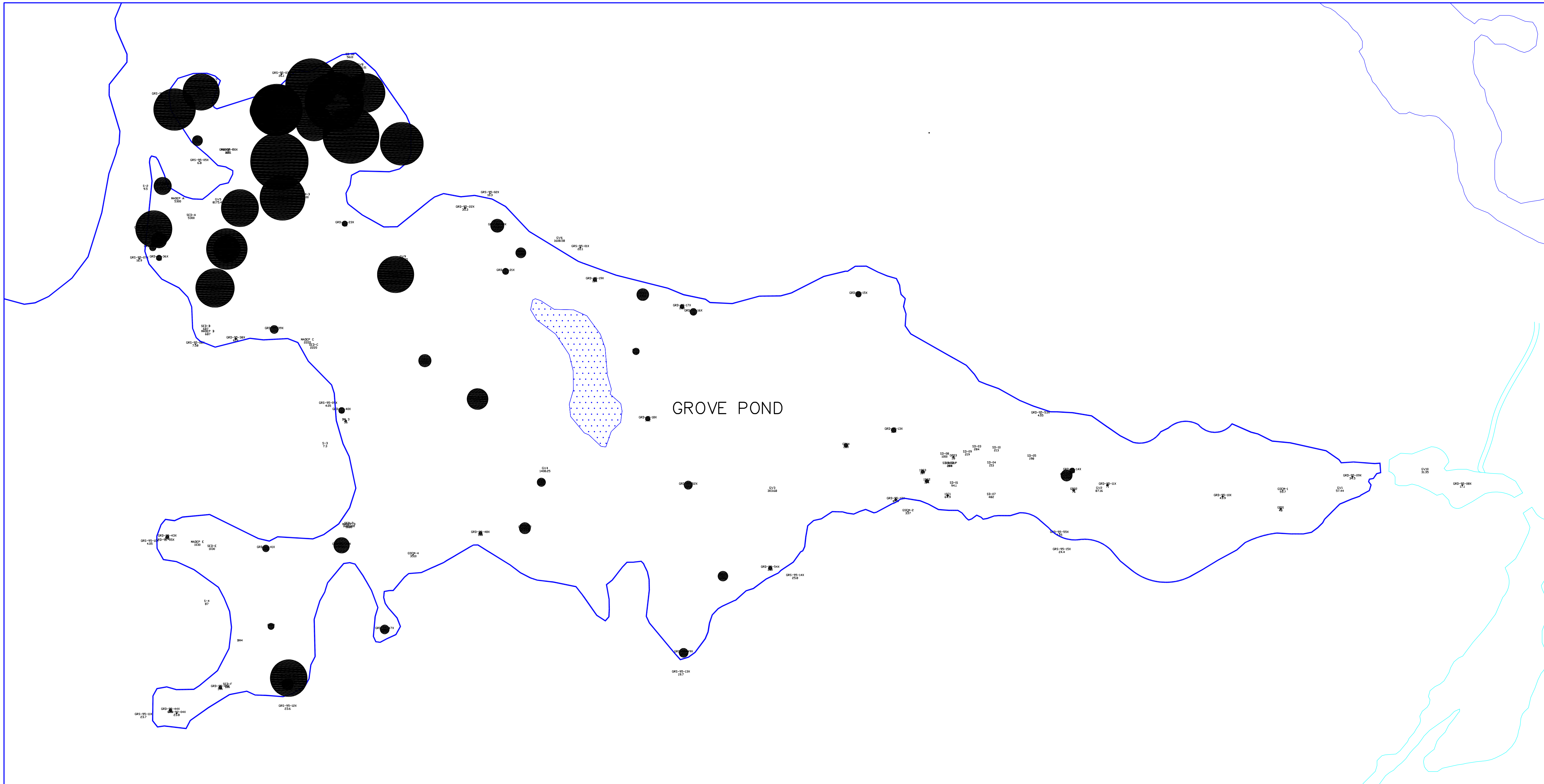


FIGURE NO.: FIGURE 5-14		REGION 1 U.S. ENVIRONMENTAL PROTECTION AGENCY BOSTON, MASSACHUSETTS
HISTOGRAMS OF CHROMIUM CONCENTRATIONS IN SHALLOW SEDIMENT (0-1 ft.) GROVE AND PLOW SHOP PONDS		EXPANDED SITE INVESTIGATION GROVE AND PLOW SHOP PONDS AYER, MASSACHUSETTS
Contract No.: EP-W-05-020	Task Order No.: #1	

Gannett Fleming



0 50 100 200

Scale: 1 inch = 100 feet

Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a chromium concentration of 52,000 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

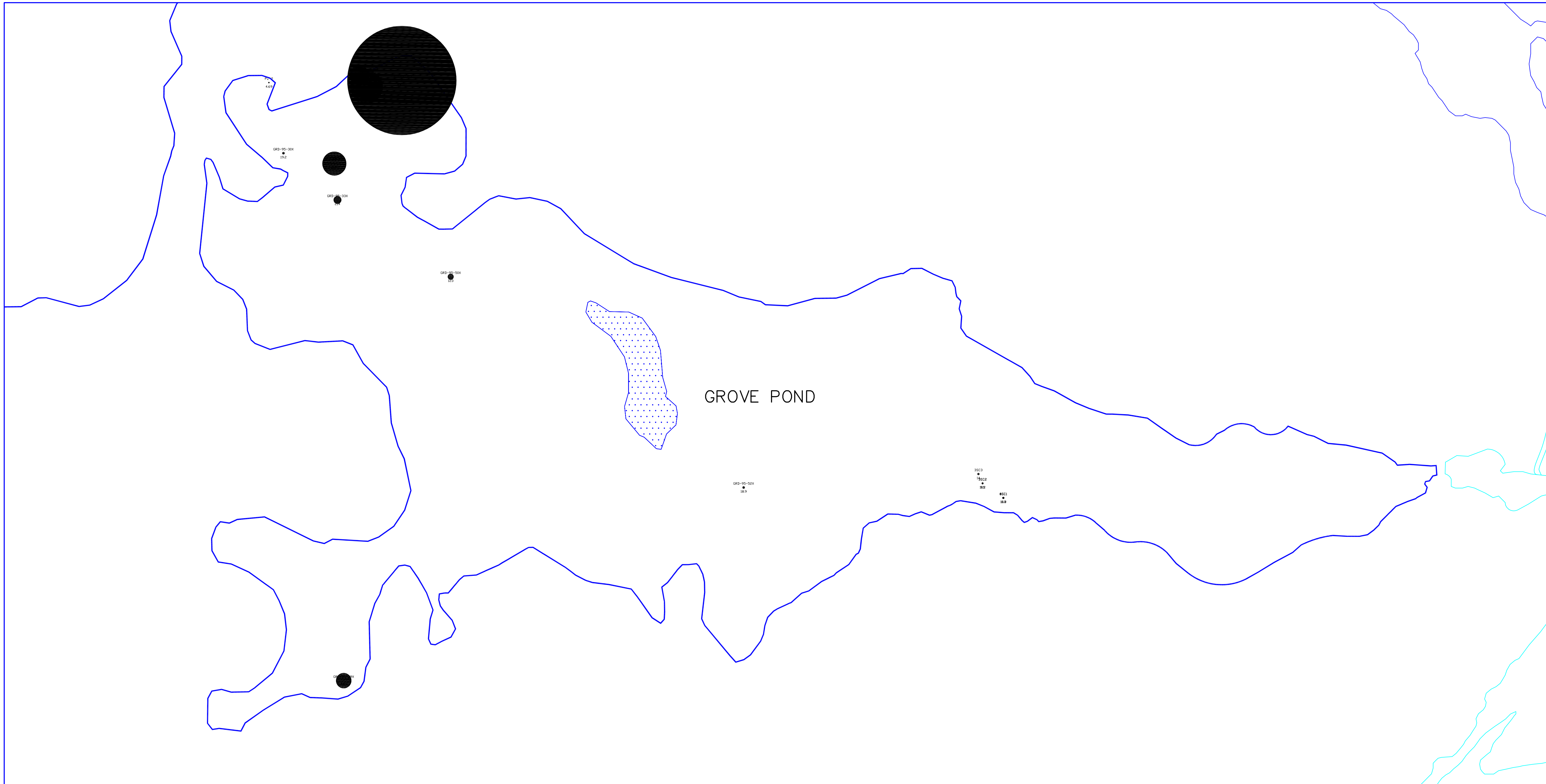
REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

CHROMIUM IN SEDIMENT
0 – 1 FOOT BELOW GRADE
GROVE POND

DRAWN BY: JB
CONTRACT NO. EP-W-05-020
TASK ORDER NO. 1
SCALE: AS SHOWN
DATE: DEC, 2005
FIGURE NO. 5-15

Gannett Fleming



0 50 100 200

Scale: 1 inch = 100 feet

Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a chromium concentration of 44,000 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

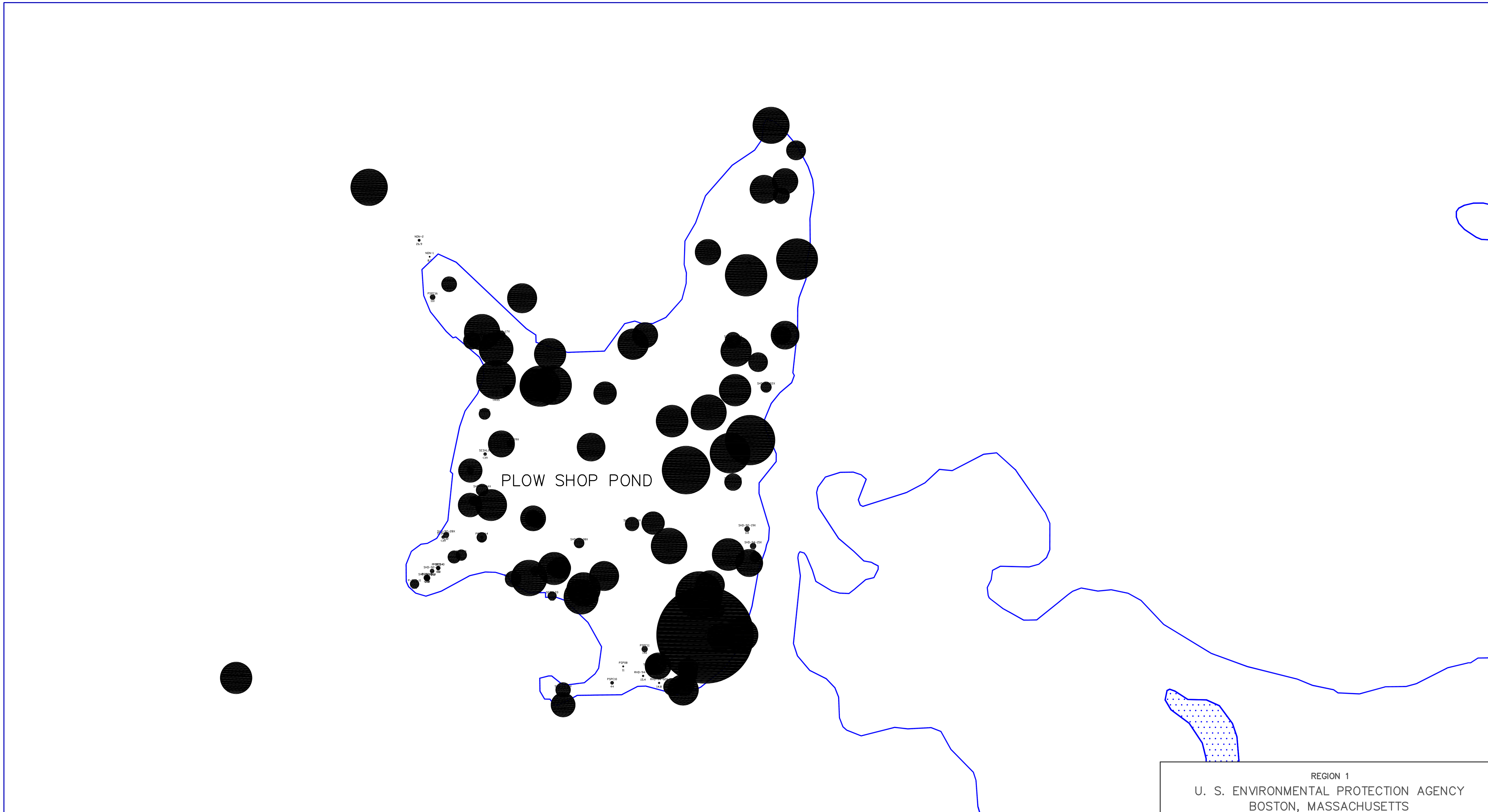
REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

CHROMIUM IN SEDIMENT
GREATER THAN ONE FOOT BELOW GRADE
GROVE POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020	SCALE: AS SHOWN	FIGURE NO.
	TASK ORDER NO. 1	DATE: DEC, 2005	5–16

Gannett Fleming



Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a chromium concentration of 37,800 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

0 50 100 200

Scale: 1 inch = 100 feet

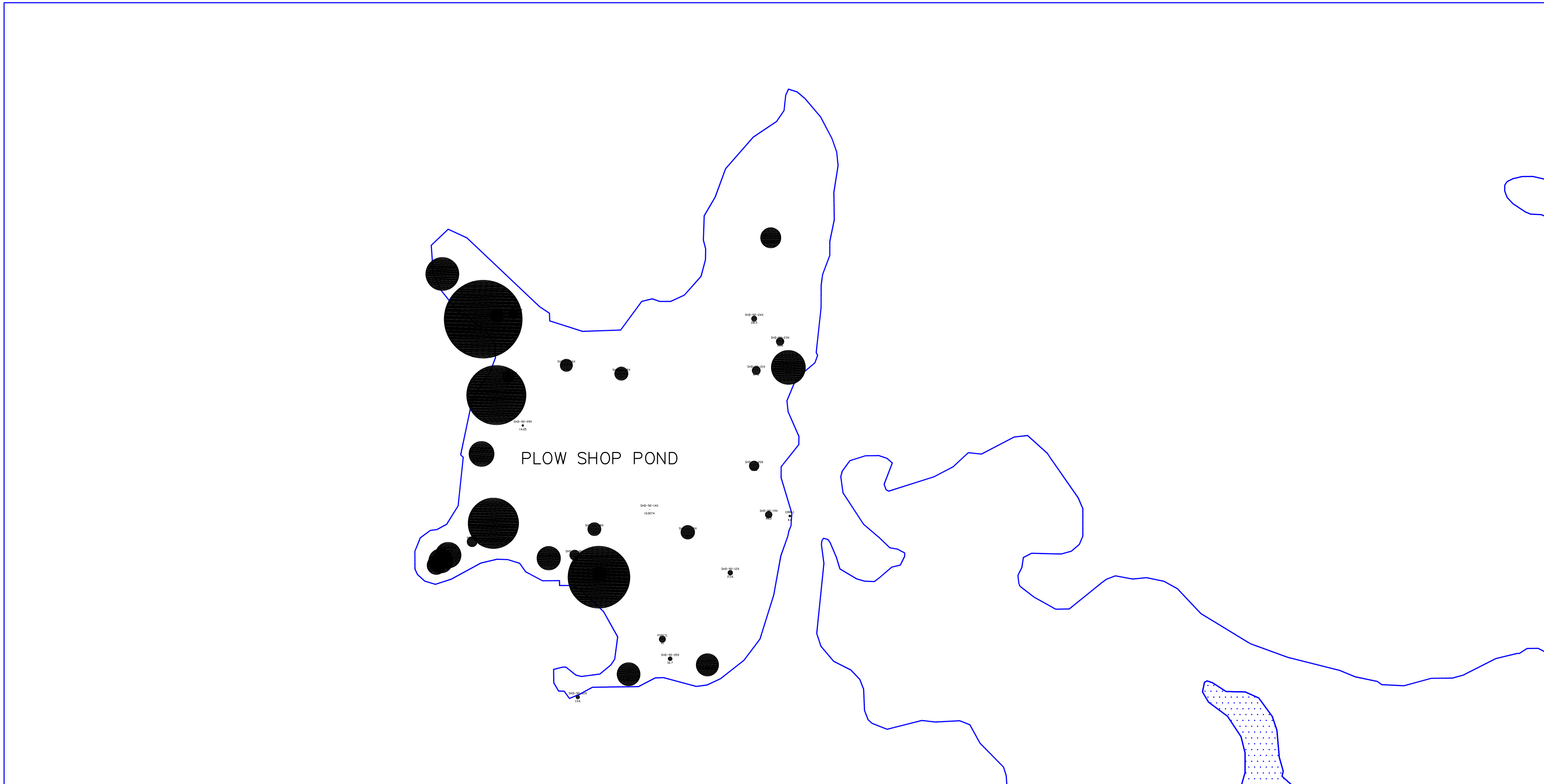
REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

CHROMIUM IN SEDIMENT
0 – 1 FOOT BELOW GRADE
PLOW SHOP POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020	SCALE: AS SHOWN	FIGURE NO.
	TASK ORDER NO. 1	DATE: DEC, 2005	5–17

Gannett Fleming



0 50 100 200

Scale: 1 inch = 100 feet

Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a chromium concentration of 5,700 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

CHROMIUM IN SEDIMENT
GREATER THAN ONE FOOT BELOW GRADE
PLOW SHOP POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020 TASK ORDER NO. 1	SCALE: AS SHOWN DATE: DEC, 2005	FIGURE NO. 5-18

Gannett Fleming

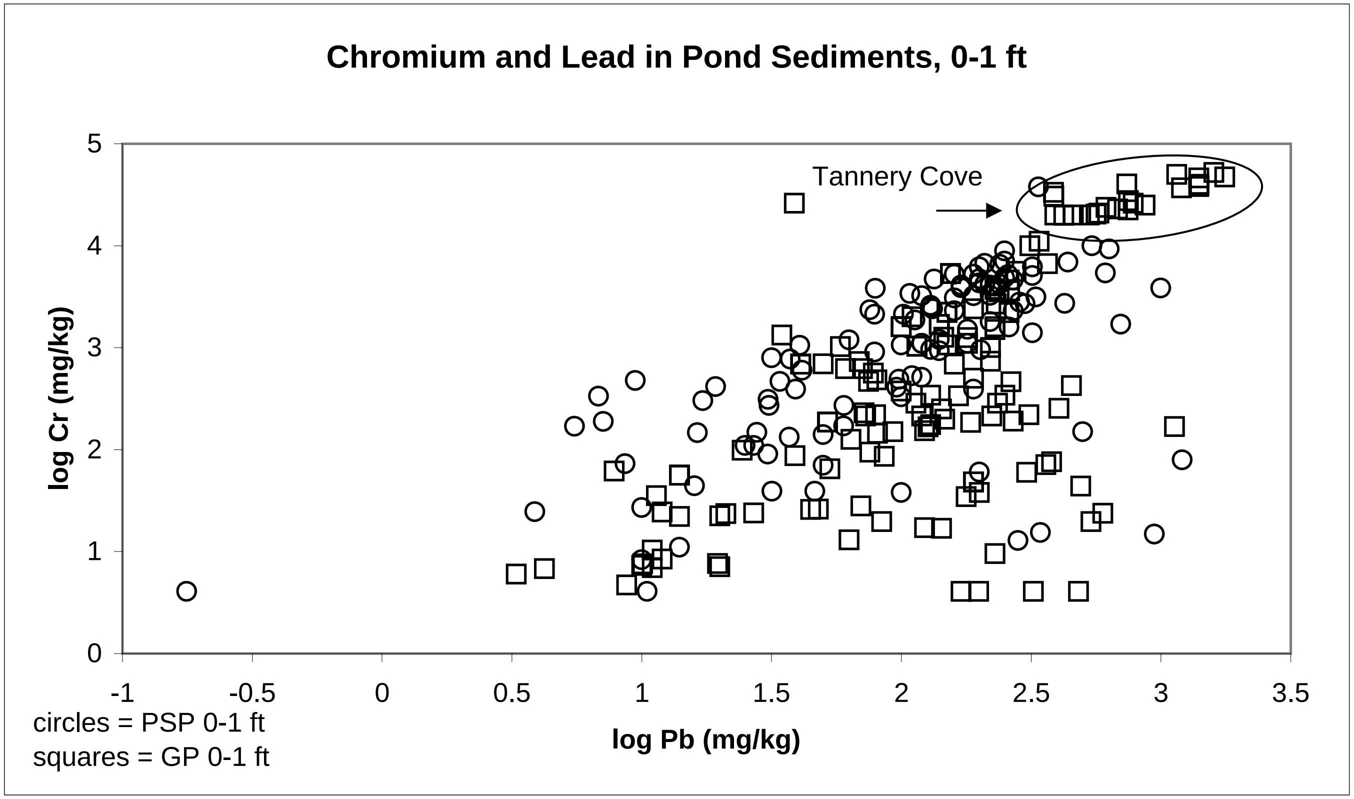


FIGURE NO.: FIGURE 5-19		**REGION 1** **U.S. ENVIRONMENTAL PROTECTION AGENCY** **BOSTON, MASSACHUSETTS**
CHROMIUM vs. LEAD IN SHALLOW SEDIMENT **0 -1 FOOT BELOW GRADE** **GROVE AND PLOW SHOP PONDS**		**EXPANDED SITE INVESTIGATION** **GROVE AND PLOW SHOP PONDS** **AYER, MASSACHUSETTS**
Contract No.: **EP-W-05-020**	**Task Order No.:** **#1**	

Gannett Fleming

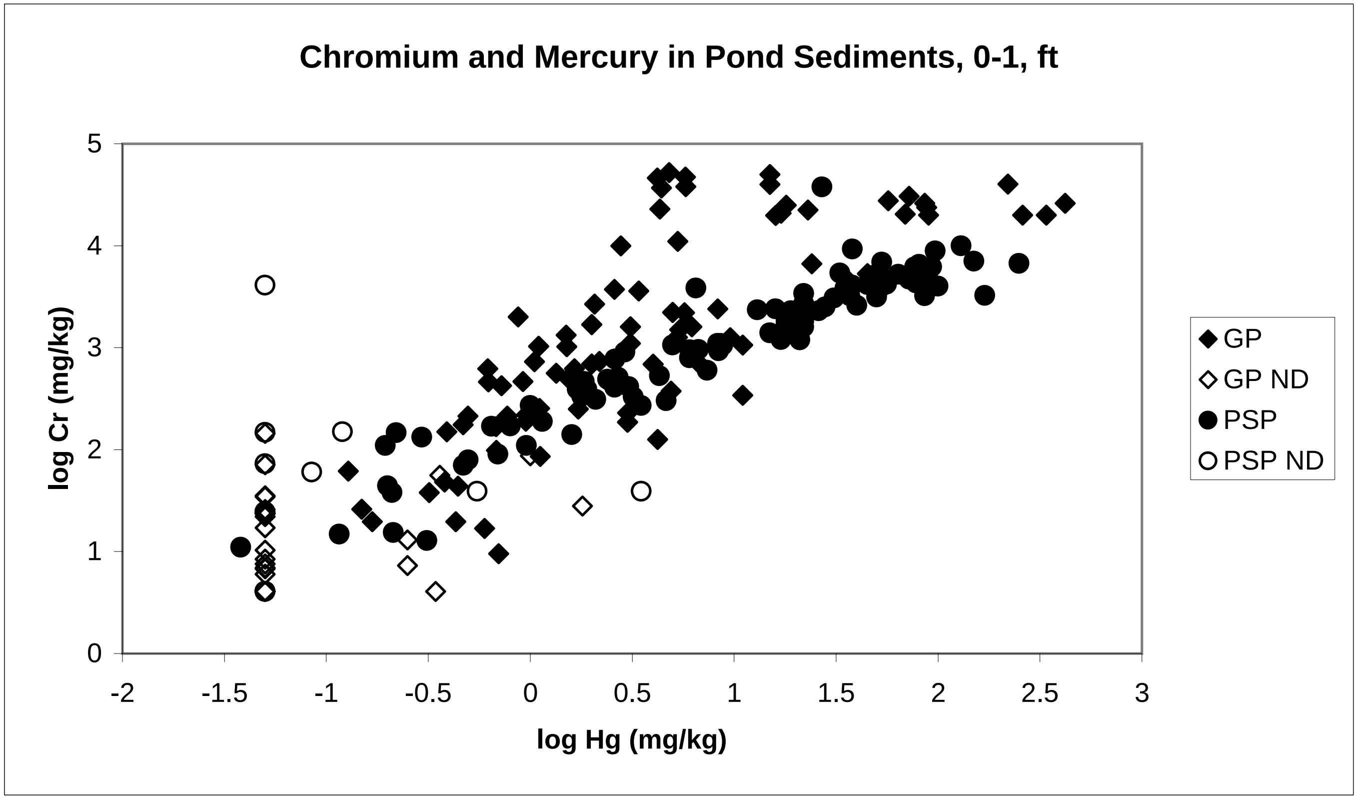


FIGURE NO.: FIGURE 5-20	**REGION 1** **U.S. ENVIRONMENTAL PROTECTION AGENCY** **BOSTON, MASSACHUSETTS**
CHROMIUM vs. MERCURY IN SHALLOW SEDIMENT **0 -1 FOOT BELOW GRADE** **GROVE AND PLOW SHOP PONDS**	**EXPANDED SITE INVESTIGATION** **GROVE AND PLOW SHOP PONDS** **AYER, MASSACHUSETTS**
Contract No.: EP-W-05-020 / **Task Order No.:** #1	

Gannett Fleming

Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a mercury concentration of 420 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

0 50 100 200

Scale: 1 inch = 100 feet

REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

MERCURY IN SEDIMENT
0 – 1 FOOT BELOW GRADE
GROVE POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020 TASK ORDER NO. 1	SCALE: AS SHOWN DATE: DEC, 2005	FIGURE NO. 5–21

Gannett Fleming

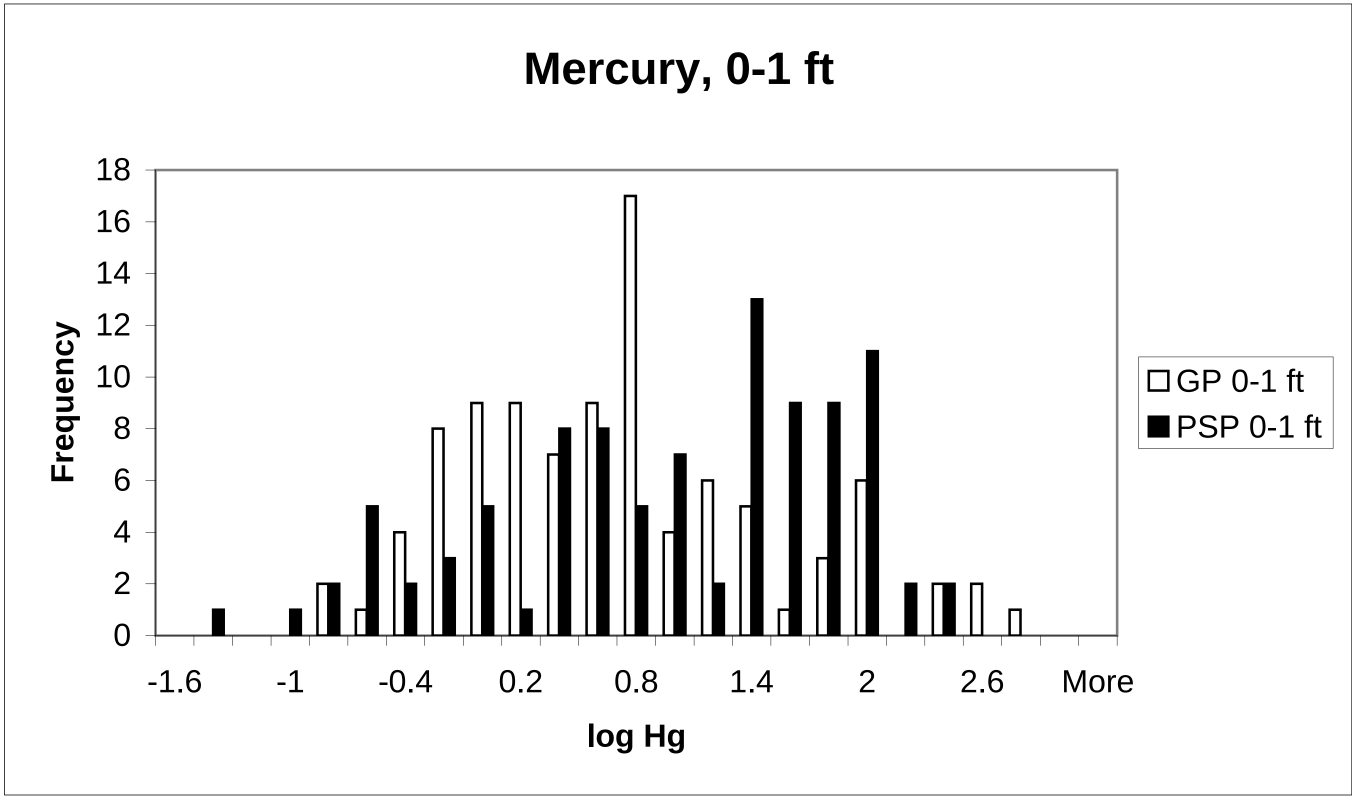


FIGURE NO.: FIGURE 5-22		REGION 1 U.S. ENVIRONMENTAL PROTECTION AGENCY BOSTON, MASSACHUSETTS
HISTOGRAMS OF MERCURY CONCENTRATIONS IN SHALLOW SEDIMENT (0-1 ft.) GROVE AND PLOW SHOP PONDS		EXPANDED SITE INVESTIGATION GROVE AND PLOW SHOP PONDS AYER, MASSACHUSETTS
Contract No.: EP-W-05-020	Task Order No.: #1	

Gannett Fleming

0 50 100 200

Scale: 1 inch = 100 feet

Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a mercury concentration of 150 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

MERCURY IN SEDIMENT
GREATER THAN ONE FOOT BELOW GRADE
GROVE POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020 TASK ORDER NO. 1	SCALE: AS SHOWN DATE: DEC, 2005	FIGURE NO. 5-23

Gannett Fleming

0 50 100 200

Scale: 1 inch = 100 feet

Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a mercury concentration of 250 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

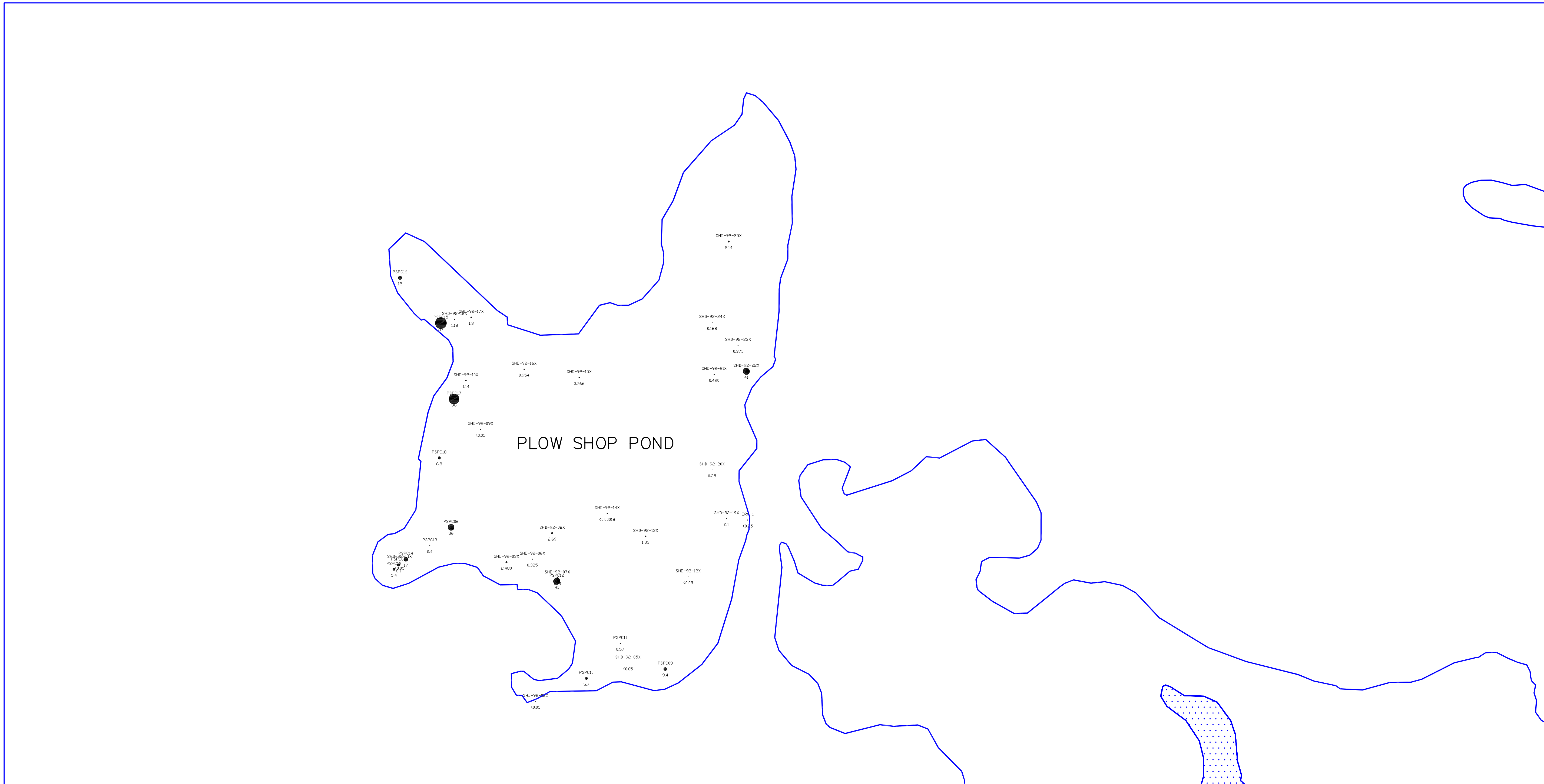
REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

MERCURY IN SEDIMENT
0 – 1 FOOT BELOW GRADE
PLOW SHOP POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020	SCALE: AS SHOWN	FIGURE NO.
	TASK ORDER NO. 1	DATE: DEC, 2005	5–24

Gannett Fleming



0 50 100 200

Scale: 1 inch = 100 feet

Notes:

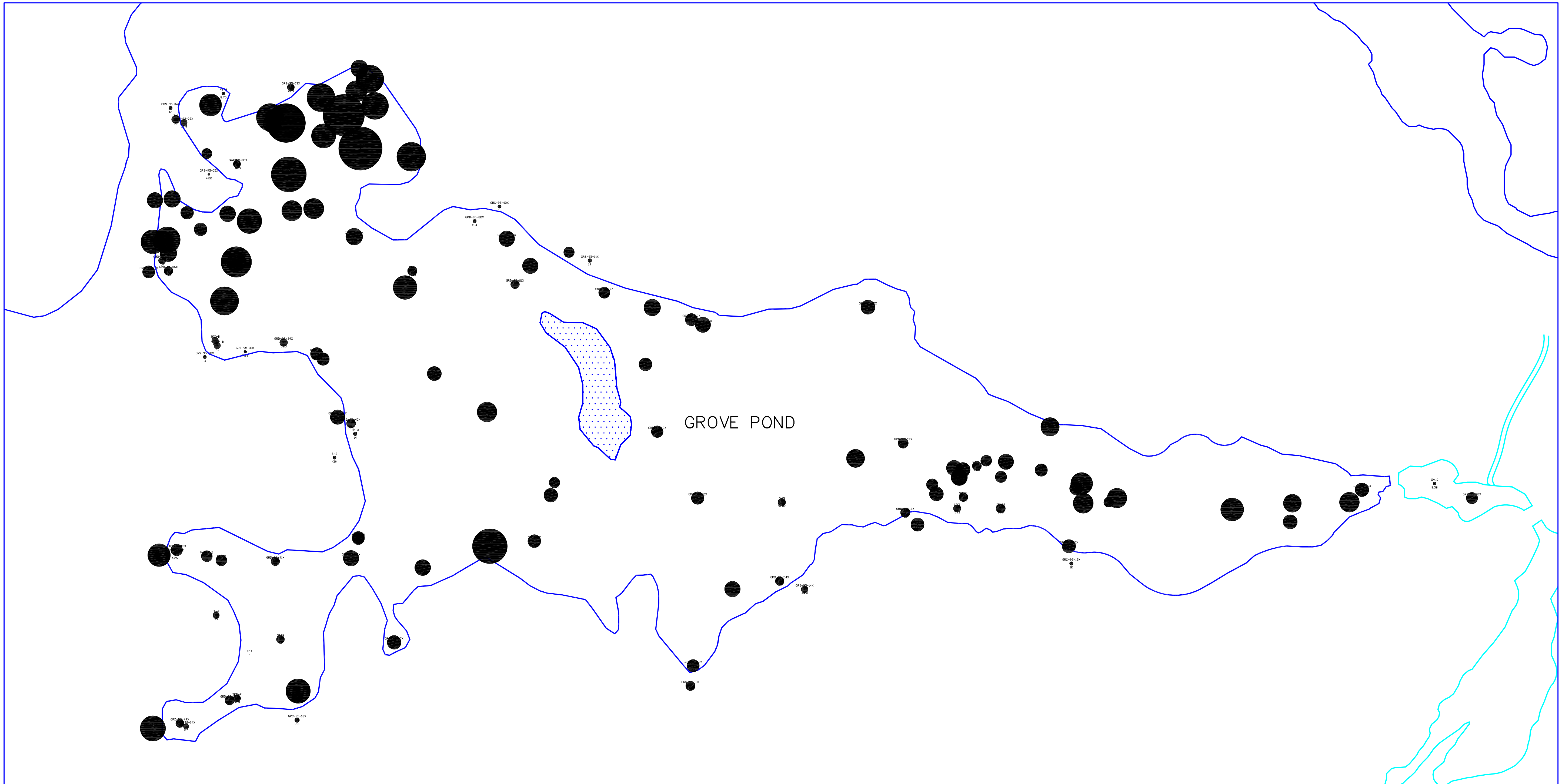
1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a mercury concentration of 220 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

MERCURY IN SEDIMENT
GREATER THAN ONE FOOT BELOW GRADE
PLOW SHOP POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020 TASK ORDER NO. 1	SCALE: AS SHOWN DATE: DEC. 2005	FIGURE NO. 5–25



Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a lead concentration of 1,760 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

0 50 100 200

Scale: 1 inch = 100 feet

REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

LEAD IN SEDIMENT
0 – 1 FOOT BELOW GRADE
GROVE POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020 TASK ORDER NO. 1	SCALE: AS SHOWN DATE: DEC, 2005	FIGURE NO. 5–26

Gannett Fleming

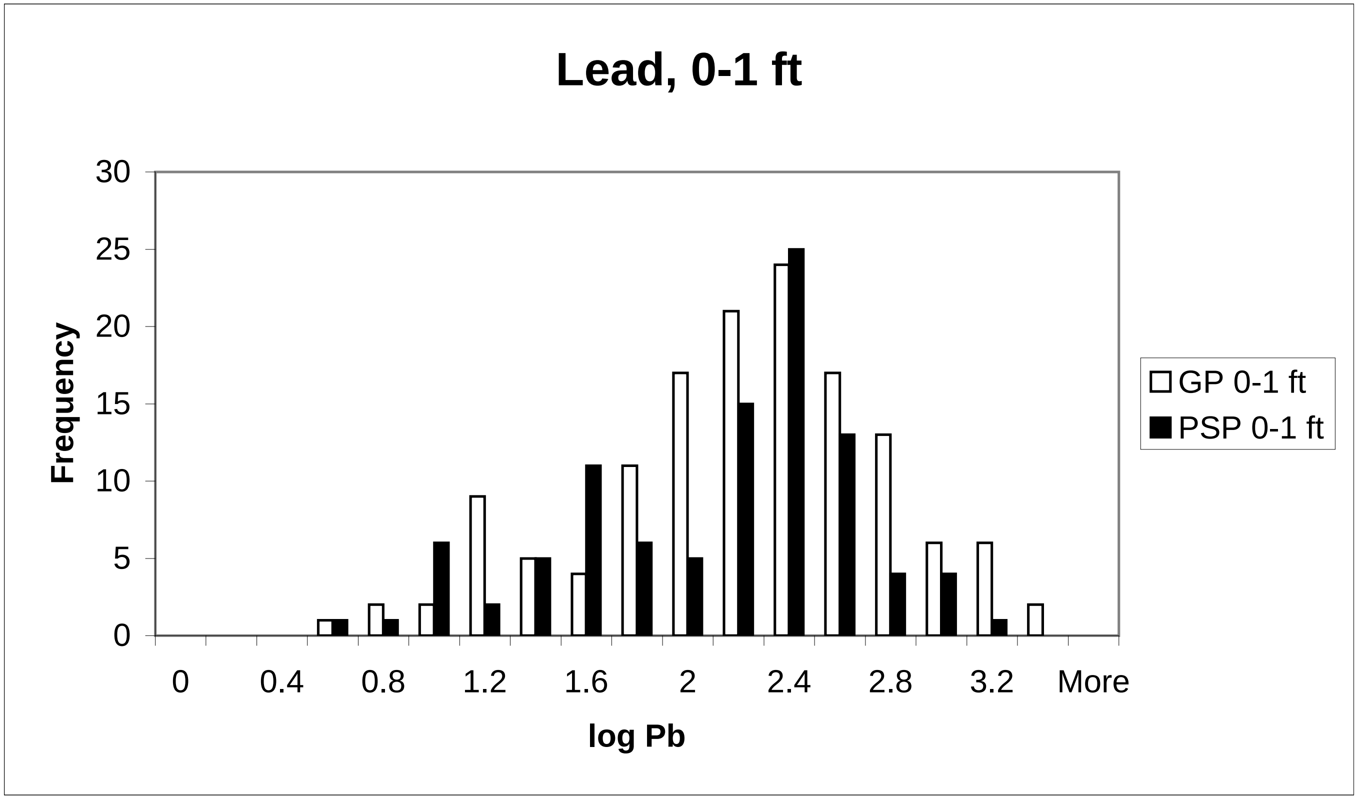
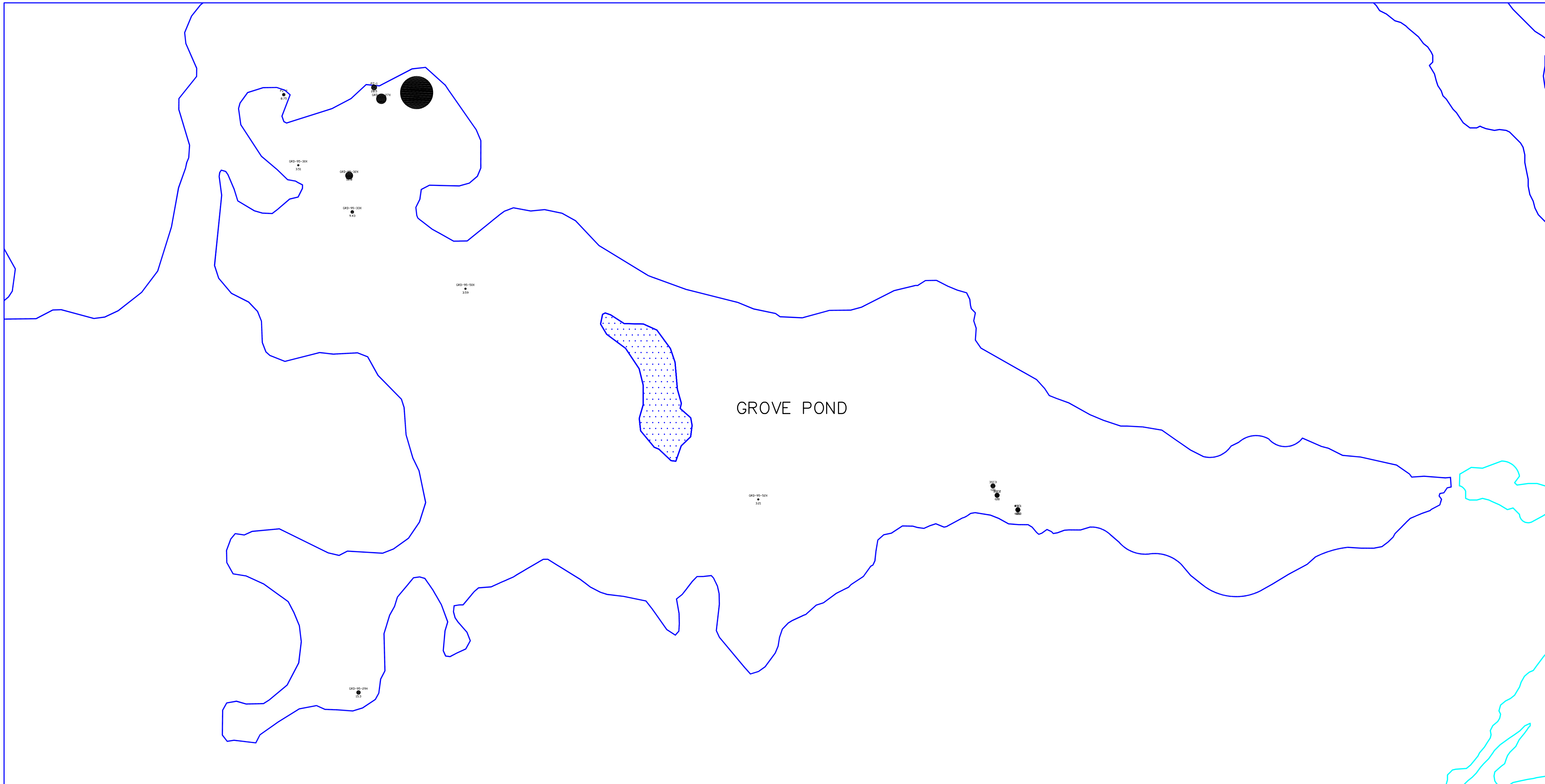


FIGURE NO.: FIGURE 5-27	REGION 1 U.S. ENVIRONMENTAL PROTECTION AGENCY BOSTON, MASSACHUSETTS
HISTOGRAMS OF LEAD CONCENTRATIONS IN SHALLOW SEDIMENT (0-1 ft.) GROVE AND PLOW SHOP PONDS	EXPANDED SITE INVESTIGATION GROVE AND PLOW SHOP PONDS AYER, MASSACHUSETTS
Contract No.: EP-W-05-020 / Task Order No.: #1	

Gannett Fleming



0 50 100 200

Scale: 1 inch = 100 feet

Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a lead concentration of 1,000 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

LEAD IN SEDIMENT
GREATER THAN ONE FOOT BELOW GRADE
GROVE POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020	SCALE: AS SHOWN	FIGURE NO.
	TASK ORDER NO. 1	DATE: DEC, 2005	5-28

Gannett Fleming

0 50 100 200

Scale: 1 inch = 100 feet

Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a lead concentration of 1,210 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

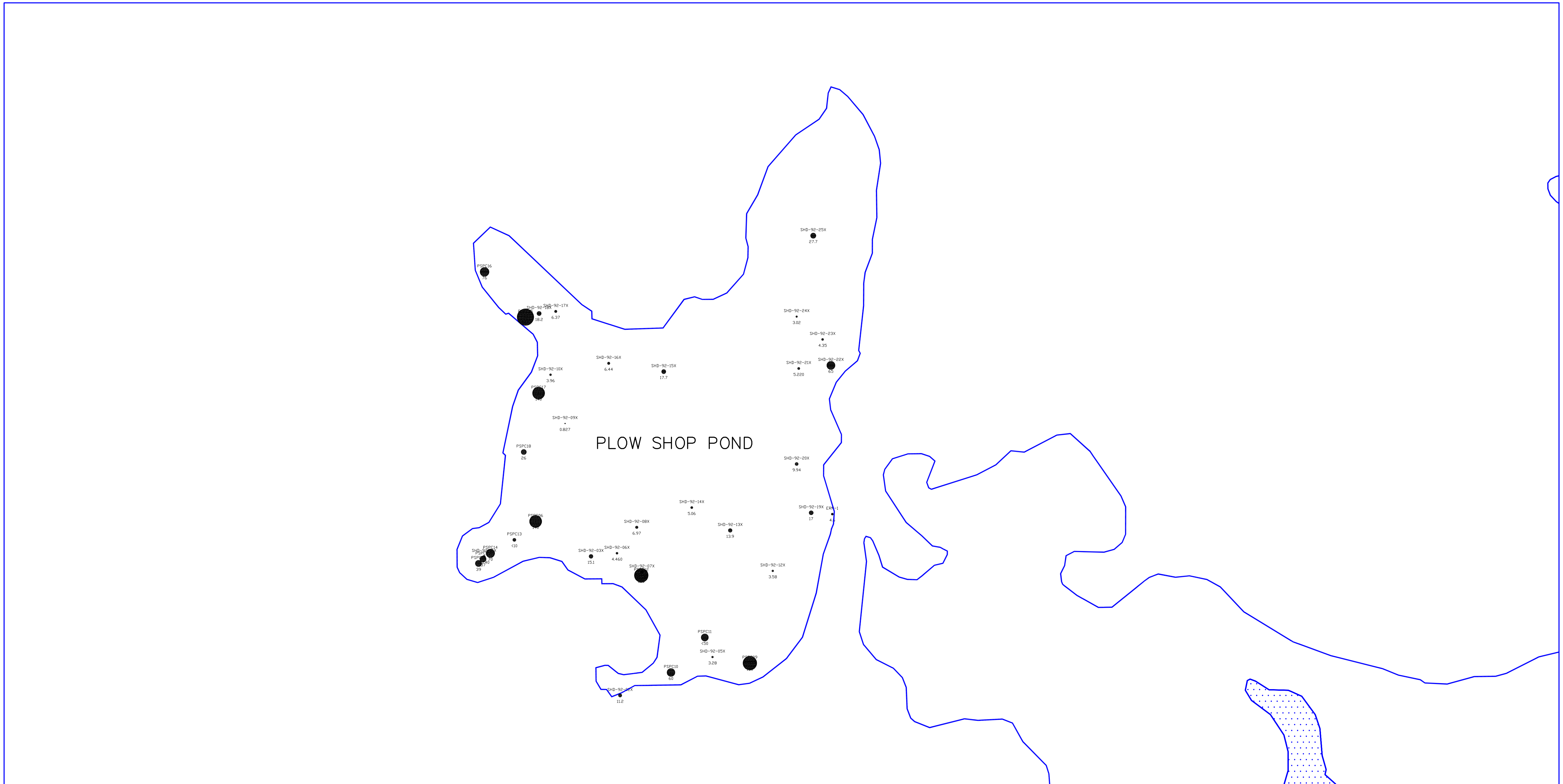
REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

LEAD IN SEDIMENT
0 – 1 FOOT BELOW GRADE
PLOW SHOP POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020 TASK ORDER NO. 1	SCALE: AS SHOWN DATE: DEC, 2005	FIGURE NO. 5–29

Gannett Fleming



0 50 100 200

Scale: 1 inch = 100 feet

Notes:

1. Base map originated from the MASSGIS database system.
2. Contaminant concentrations reported in milligrams per kilogram (mg/kg).
3. The area of the bubbles shown on the figure are proportional to the square root of the contaminant concentration. The largest bubble corresponds to a lead concentration of 260 mg/kg. All other smaller bubbles are proportional to the contaminant concentration (Refer to Section 5.2 in the text).

REGION 1
U. S. ENVIRONMENTAL PROTECTION AGENCY
BOSTON, MASSACHUSETTS

EXPANDED SITE INVESTIGATION
GROVE AND PLOW SHOP PONDS
AYER, MASSACHUSETTS

LEAD IN SEDIMENT
GREATER THAN ONE FOOT BELOW GRADE
PLOW SHOP POND

DRAWN BY: JB	CONTRACT NO. EP-W-05-020 TASK ORDER NO. 1	SCALE: AS SHOWN DATE: DEC, 2005	FIGURE NO. 5-30

Gannett Fleming

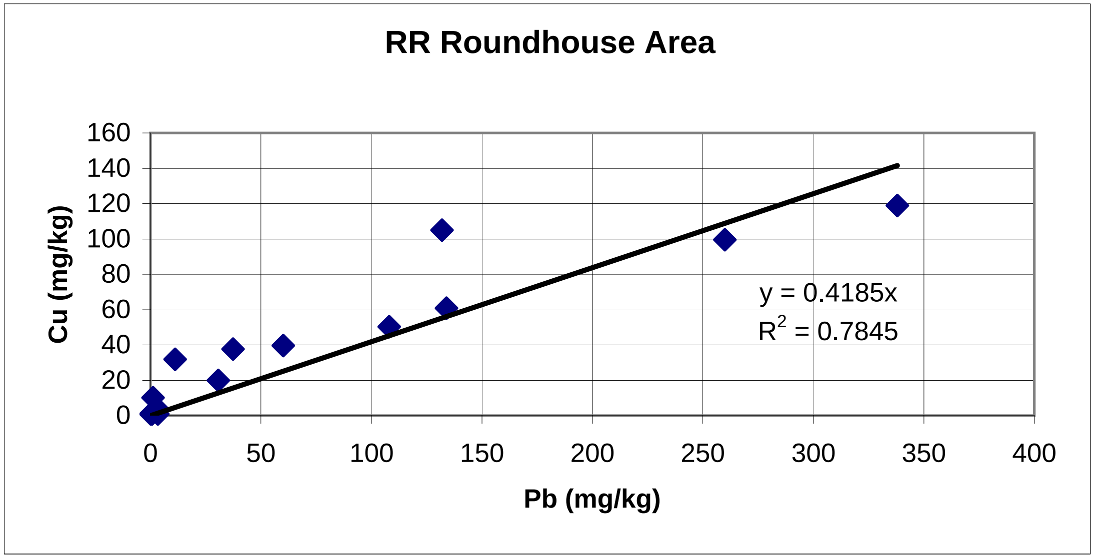


FIGURE NO.: FIGURE 5-31		REGION 1 U.S. ENVIRONMENTAL PROTECTION AGENCY BOSTON, MASSACHUSETTS
COPPER vs. LEAD IN SHALLOW SEDIMENT ADJACENT TO THE RAILROAD ROUNDHOUSE 0 -1 FOOT BELOW GRADE		EXPANDED SITE INVESTIGATION GROVE AND PLOW SHOP PONDS AYER, MASSACHUSETTS
Contract No.: EP-W-05-020	Task Order No.: #1	

Gannett Fleming

Figure 5-32. Shallow Groundwater Elevations, Nov. 15, 2004.

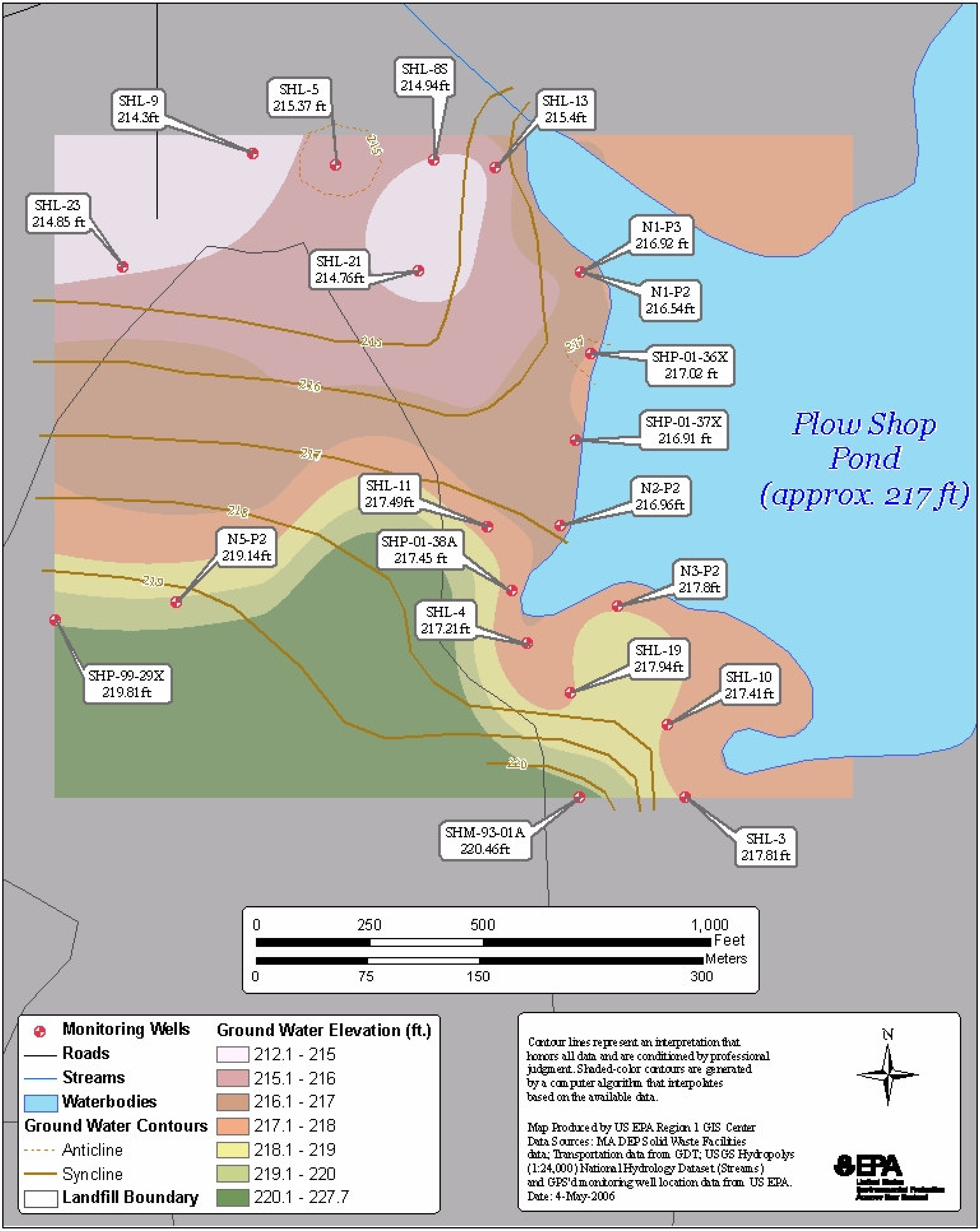
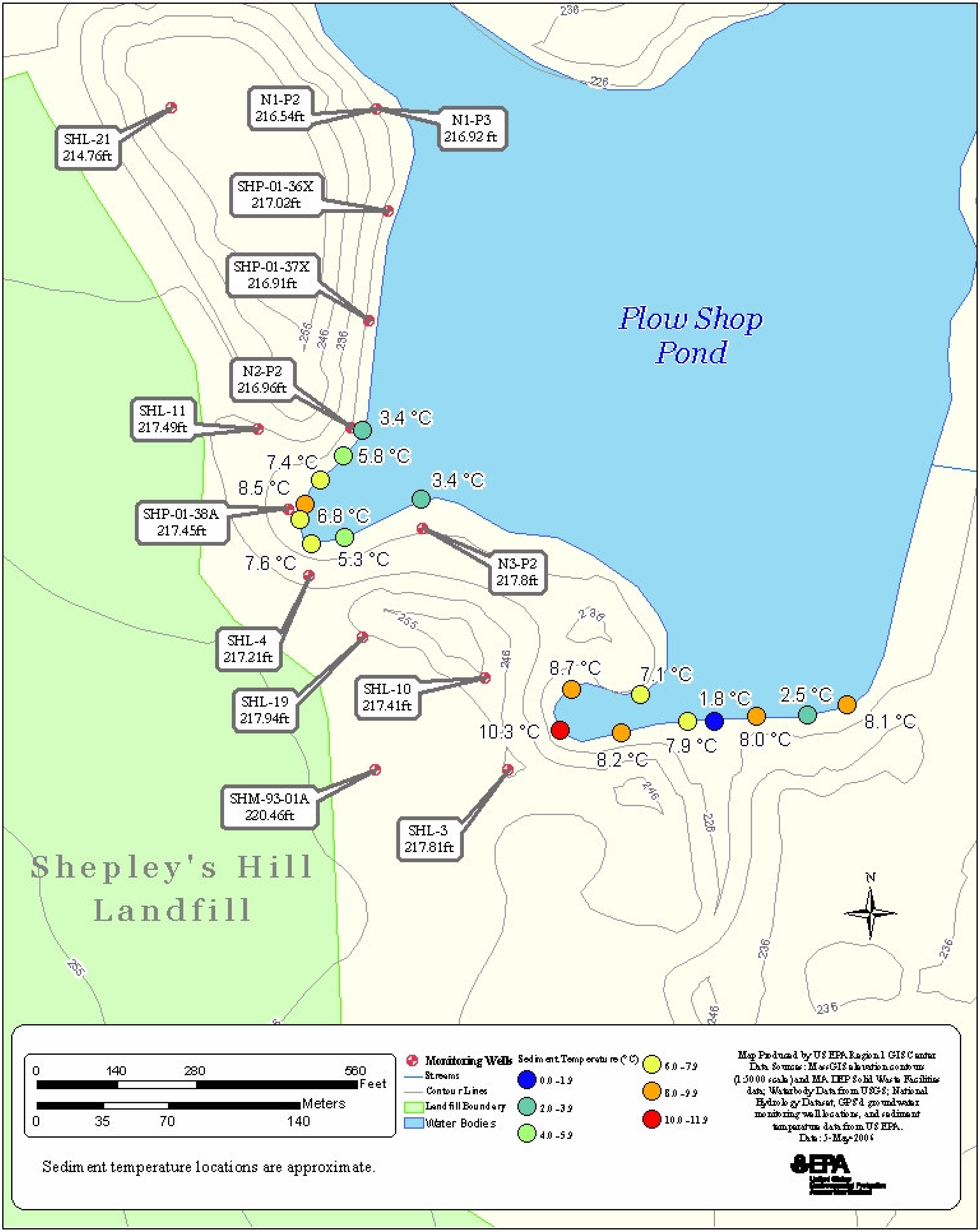


Figure 5-33: Shallow (1 ft) Sediment Temperature



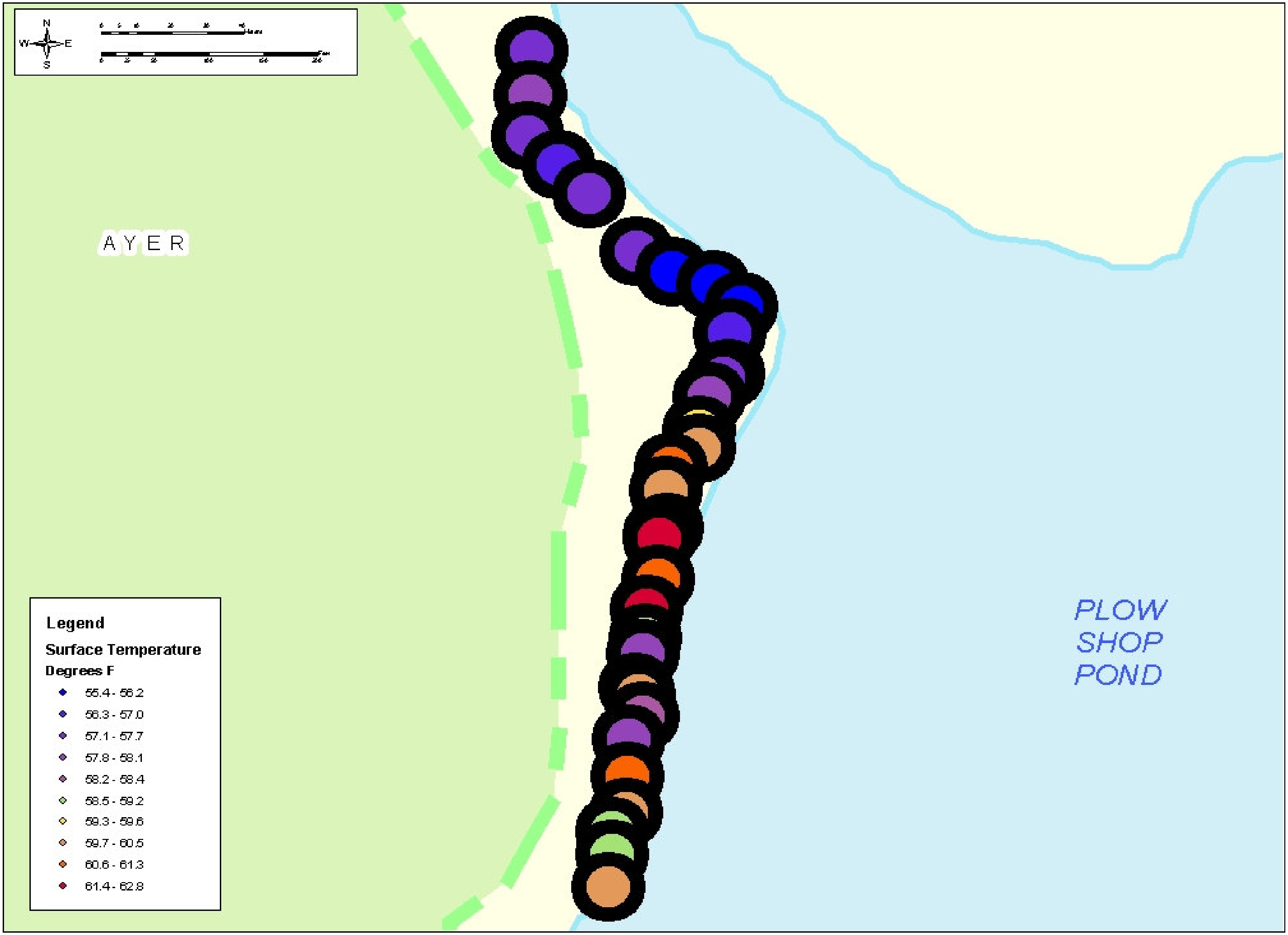


Fig. 5-34: Sediment temperature 1 ft below water-sediment interface, April, 2005 (EPA, 2005, unpublished).

APPENDIX A

LIST OF DATA SOURCES

List of Data Sources
Grove Pond and Plow Shop Pond ESI

Notations:
[1] GF/Newton
[2] BRAC Library
[3] GF/NH

1. February 1985. *21E Site Assessment, Bligh Street, Ayer, Massachusetts*. IEP, Inc., (Northborough, MA). Six test pits were excavated on the former tannery property. Groundwater and soil samples were analyzed for inorganics; Ba, Hg, Pb, Se, and Cr were found to be in excess of MCLs in groundwater; As, Ba, Cu, Hg were elevated in soil (Cr was not analyzed).

[1] [2]

2. April 1993. *Final Remedial Investigation Report for Areas of Contamination 4, 5, 18, 40, Fort Devens, Massachusetts.* Prepared for the U.S. Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, Maryland by Ecology and Environment, Inc. (E&E). RI at Fort Devens Group 1A Sites. Surface water and sediment samples were collected from Plow Shop Pond and analyzed for VOCs, pesticides, and inorganics. Chloroform and methylene chloride were found in several water samples; Cu, Ag, Zn exceeded Ambient Water Quality Criteria (AWQC). Sediments were analysed for organics, metals, and TOC, and were found to be high in metals; low concentrations were reported for PAHs and VOCs. Two sediment-water sample pairs were collected from the Nonacoicus Brook wetlands. The surface water inorganics were similar to concentrations in Plow Shop Pond surface water; sediments did not report unusually high inorganics.

[1] [2]

3. January 1993. *Town of Ayer, Massachusetts Grove Pond Wells Hydrogeologic Investigation and Zone II Aquifer Mapping*. Camp Dresser & McKee Inc. Contains MODFLOW results from May 1992 and Sept. 1992 pump tests; Zone II delineation; sensitivity analysis; water budget; conceptual hydrologic model; particle track simulation; groundwater chemistry for 3 sampling events during pump test in September 1992.

[1] [3]

4. June 1993. *UST Closure Report, New England Telephone Company Garage, Sandy Pond Road, Ayer, MA.* Prepared by EnviroTEL, Inc. for New England Telephone, Boston, MA. This site is too distant to have an impact to the study area.

[1]

5. September 1993. *Concentrations of mercury and other environmental contaminants in fish from Grove Pond, Ayer, Massachusetts*, US Fish and Wildlife. Fish filets from Grove Pond were analyzed for inorganics that included Hg, Cr, As, Pb, and PCBs. Four samples exceeded World Health Organization limits for Pb; one sample exceeded FDA action level for Hg, and low PCBs were found in some.

[1] [2]

6. December 1993. *Final Remedial Investigation Addendum Report, Data Item A009. Vol. I of IV, Report Text.* Prepared by ABB-ES, Inc., for US Army Environmental Center, Aberdeen Proving Ground, Maryland.

   Collected supplemental samples from Plow Shop Pond, Nonacoicus Brook Wetland, and Grove Pond to fill identified data gaps; also discusses data from Plow Shop Pond, Shepley's Hill Landfill, Cold Spring Brook Landfill, New Cranberry Pond, and Nonacoicus Brook wetlands.

   Grove Pond: Data from five surface water and five surface sediment samples; analytes included PAL VOCs, SVOCs, pesticides, PCBs, explosives, inorganics. No organics were reported; highest concentrations of inorganics, including As, Cd, Cr, Cu, Pb, Mn, Hg, Ni, and Zn, were found in sediments from the pond's northwest corner. Of these, As, Cr, Cu, Pb, Pb, and Hg were found to be in excess of the Ontario Sediment Guidance (OSG) Serious Effect Level.

   Plow Shop Pond: 68 sediment samples at 25 locations. Analytes included inorganics, pesticides, PCBs, TOC. Concluded that Plow Shop Pond sediments are contaminated with As, Ba, Cr, Cu, Fe, Pb, Mn, Hg, Ni, and Zn. The former tannery, Shepley's Hill Landfill, and former railroad roundhouse were identified as probable contributors. A fish community study, fish tissue contaminant study, and macroinvertebrate studies were also conducted as part of supplemental RI.

   Nonacoicus Brook Wetland: surface soil and shallow groundwater samples taken from four shallow, hand-dug pits immediately north of SHL. Analyzed for VOCs, pesticides, PCBs, explosives, and inorganics. No PAL organics reported from groundwater, but Ba, Ca, K, Mn, Pb, and Zn were contaminants in groundwater. In soils, no VOCs, PCBs, or explosives were reported; low concentrations of DDE and DDT. 20 PAL inorganics detected, concentrations of 16 exceeded background levels at least once. Be, Cr, Cu, Hg, Ag, Zn considered contaminants in soil samples; Cr and Hg highest near Nonacoicus Brook.

   Railroad roundhouse area: three shallow soil samples and one pond sediment sample; some low concentrations of SVOCs, and elevated levels of As, Sb, Cu, and Pb.

   Vol. II of IV, Appendix A-G.

   Vol. III of VI, Appendix H. Laboratory QC results.

Vol. IV of IV, Appendices I-Z. Contains background Devens soil and groundwater concentrations (metals); RI sediment summaries (Shepley's Hill and Cold Spring Brook Landfills).

[1] [2] [3]

7. March 1994. *Interim Comprehensive Site Assessment, Ayer Municipal Landfill, Groton – Harvard Road Volume 1* – Text

   Volume II – Round 1 sampling results - DEP did not have

   Volume III – Round 2 sampling results did not get section 4.

[1]

8. April 1994. *Site Assessment Report, Boston & Maine Railroad Property, Fort Devens, Ayer, Massachusetts*. Prepared by ERM for Boston & Maine Corporation. During this investigation of the Hill Yard for Guilford Transportation, 8 groundwater-monitoring wells were installed, and soil and sediment samples were taken from Grove Pond adjacent to the Yard. Results from groundwater and soil samples did not pose any problems, but elevated levels of As, Cd, Cr, Cu, Pb, Hg, Ni, and Zn were found in sediment.

[1]

9. June 1994, *Sampling and Analysis Report, Bligh Street Facility*. Green Environmental. Surface soil sampling and metals analysis at tannery site in response to a January 1994 NOR. 30 surface soil samples but no analytes found (samples were from fill after the 1961 fire).

[1]

10. October 1994. *Final Railroad Roundhouse Supplemental Site Investigation Work Plan, Data Item A004.* Prepared by ABB-ES, Inc., for US Army Environmental Center, Aberdeen Proving Ground, Maryland.

    This document contains March 1993 surface soil sampling results (organics, pesticides, inorganics, TOC).

[3]

11. December 1, 1994 (October 1994), *Grove Pond Field Investigation*. Prepared by Metcalf & Eddy for MADEP. Six Grove Pond surface water and sediment samples were collected; surface water was analyzed for VOCs, SVOCs, pesticides/PCBs, TAL metals, suspended and dissolved solids, and hardness. Sediments were analyzed for VOCs, SVOCs, pesticides/PCBs, TAL metals, TOC, grain size, and percent solids. Low levels of some pesticides were found, and As, Cd, Cr, Cu, Pb, and Hg exceeded Ontario Sediment Guidance (OSG) criteria.

[1]

12. December 1994. *Phase I – Initial Site Investigation Plastic Distributing Corporation, Bligh Street Facility, Ayer, MA. Quincy, MA.* Green Environmental, Phase I investigation of the tannery site. Four soil borings were

taken during the installation of four shallow monitoring wells between the filled-in cove and the former tannery site, and five subsurface soil samples were collected from borings in the same area. Elevated concentrations of metals were found in soil, and both metals and organics were found in groundwater (TPH, As, Ba, Cr, Pb, Hg in soil; As, Cr, Pb, Hg, xylene, TCE in groundwater).

[1] [2]

13. February 1995. *Final Feasibility Study: Shepley's Hill Landfill Operable Unit, Data Item A009.* Prepared by ABB-ES, Inc., for US Army Environmental Center, Aberdeen Proving Ground, Maryland.

    This study includes discussion and analysis of remedial alternatives, summary of groundwater modeling results.

[1] [3]

14. February 1995. *Final Grove Pond Site Investigation Work Plan, Data Item A004.* Prepared by ABB-ES, Inc., for US Army Environmental Center, Aberdeen Proving Ground, Maryland.

    Tabulated data from Dec. 93 RI are contained in this document.

[1] [3]

15. February 1995. *Final Feasibility Study Shepley Hill Landfill.*

[1]

16. April 1995. *RAO Statement and Supporting Documentation.* Prepared by Handex of NE, Inc. for NYNEX, Boston, MA.

[1]

17. April 1995. *Lower Cold Spring Site Investigation Data Package.*

    The December 1995 report updates this report

[1]

18. May 1995. *Detailed Flow Model for Main and North Post, Fort Devens, Massachusetts.* Prepared by Engineering Technologies Associates, Inc. (ETA) for commander, US Army Toxic and Hazardous Materials Agency. Ellicott City, Maryland.

    This report documents a numerical model for the basewide groundwater hydrology, including a Zone II delineation for the Devens Grove Pond water-supply wells.

[3]

19. June 1995. *Final Delivery Order Work Plan: Predesign Investigations, Areas of Contamination (AOCs) 4, 5, and 18, Shepley's Hill Landfill, Fort Devens, Massachusetts.* Prepared by Stone & Webster Environmental Technology & Services for US Army Corps of Engineers, New England Division.

[3]

20. September 1995. *Railroad Roundhouse Supplemental Site Investigation, Data Item A009.* Prepared by ABB-ES, Inc., for US Army Environmental Center, Aberdeen Proving Ground, Maryland.

Four shallow sediment samples were collected for confirmation of the 1993 data. In addition, 46 shallow soil samples were taken from 15 test pits and analyzed for SVOCs, inorganics, and TOC. Two new water-table monitoring wells were installed downgradient of the roundhouse, and two rounds of sampling two existing and the two new wells were conducted. Analytes included SVOCs and total and dissolved metals.

In sediment data, low levels of 13 SVOCs were reported. In addition, exceedances of sediment criteria for As, Cr, Cu, Fe, Pb, Hg, Ni, and Zn were found; it was concluded that disposal of maintenance by-products near pond was responsible for elevated Sb, Cu, and Pb. Soils from the maintenance by-products disposal area also reported As (barely), Ba, Cr, Cu, Pb, V, Sn, Zn higher than background. Concentrations of inorganics from soil samples taken near the railroad roundhouse and turntable area were not exceptionally high in comparison to background values. Groundwater samples did not indicate evidence of site-related contamination. Preliminary Risk Evaluations indicated potential risk to human health and to ecological receptors due to SVOCS and the presence of elevated levels of inorrganics (Sb, As, Cu, Pb, and Sn) in soils and near-shore sediments. The observed levels of Sb, Cu, and Pb are attributed to disposal of maintenance by-products. It is noted that the Army uses site-specific background concentrations to evaluate contamination at the roundhouse site, according to the Massachusetts Contingency Plan (MCP) definition of "background," which includes "…fill materials containing…coal ash." The MCP definition thus precludes the identification of elements uniquely attributable to coal ash as COPCs.

[1] [3]

21. October 1995. *Draft Plow Shop Pond and Grove Pond Sediment Evaluation, Data Item A009.* Prepared by ABB Environmental Services, Inc., for US Army Environmental Center, Aberdeen Proving Ground, Maryland.

Vol. I, Sections 1.0 - 8.0. Summary of previous risk assessments; toxicity testing; and field investigation results: Grove Pond sediments (SVOCs, pesticides, PCBs, metals, Hg, TOC), surface soils and surface waters; Plow Shop Pond sediments (metals, pH, TOC, Hg), pore water (metals, Hg), and acid-volatile sulfides and simultaneously extracted metals.

Analyses are reported for 65 sediment samples from 48 locations at Grove Pond; 71 sediment samples from 28 locations in Plow Shop Pond. Grove Pond sediment samples reported exceedances of As (up to 1300 μg/g), Cr (47000 μg/g), Pb (up to 1760 μg/g), and Hg (220 μg/g). The Preliminary Risk Evaluation (PRE) conducted by Army at that time reported that these four metals exceeded human health screening values.

Vol. II, Appendices A-M: details of toxicity testing, water quality parameters, grain size analysis, data quality evaluation.

[1] [3]

22. December 1995. *Draft Long Term Monitoring and Maintenance Plan, Shepley's Hill Landfill, Fort Devens, Massachusetts.* Prepared by Stone & Webster Environmental Technology & Services for US Army Corps of Engineers, New England Division.

    Establishes baseline concentrations in downgradient groundwater (VOCs and inorganics, data in Appendix B); data are from RI sampling in Aug. and Dec. 1991 and supplemental RI sampling in March and June 1993.

[3]

23. December 1995. *Monitoring Well Installation Final Work Plan: Shepley's Hill Landfill Areas of Contamination (AOCs) 4, 5, and 18, Fort Devens, Massachusetts.* Prepared by Stone & Webster Environmental Technology & Services for US Army Corps of Engineers, New England Division.

[3]

24. December 1995. *Lower Cold Spring Brook Site Investigation Report*, Data Item A009, prepared by ABB-ES for US Army.

[1] [2]

25. March 1996. *Groundwater Model Update Report, Predesign Investigations, Areas of Contamination (AOCs) 4, 5, and 18, Shepley's Hill Landfill, Fort Devens, Massachusetts.* Prepared by Stone & Webster Environmental Technology & Services for US Army Corps of Engineers, New England Division.

    Contains revisions to previous MODFLOW results, boring logs, slug test results, daily reports.

[3]

26. March 1996. *Close out Report – Shepley Hill Landfill.*

[1]

27. January 1997. *1996 Annual Report – Shepley Hill Landfill.*

[1]

28. January 1997. Letter Report: Revised Zone II Delineations for Devens Water Supply Wells. January 20, 1997. From Earth Tech to A. Delaney, Municipal Engineer.

    Modified previous Zone II delineation (determined from MODFLOW results)

[3]

29. June 1997. *Hartnett Tannery Site, Ayer, Middlesex County, Massachusetts Site File*. Prepared by Roy F. Weston, Inc. for EPA. Soil samples were collected from 19 pits on PDC property. Findings included PCBs (110 mg/kg) in one pit; also, As, Cr, Cu, Pb, Hg, Ni, V, and Zn were reported above background concentrations in one or more samples. Maximum values reported for these elements are: As, 5520 mg/kg; Cr, 18000 mg/kg; Cu, 2560 mg/kg; Pb, 618 mg/kg; Hg, 4.3 mg/kg, Ni, 50.6 mg/kg, V, 161 mg/kg; and Zn, 867 mg/kg.

[1]

30. August 1997. Data reported to Massachusetts DEP. PDC Surficial Soil Sampling: EPA 24 surface soil samples were collected and analyzed for metals and PCBs. No PCBs reported, and metals appeared to be low except for one sample.

[1]

31. August 1997. Data reported to Massachusetts DEP. Town of Ayer Grove Pond water-supply well sampling by the Ayer Department of Public Works. Raw water was sampled but found to contain no inorganics exceeding MCLs.

[1]

32. December 1997. *Plow Shop Pond and Grove Pond Ecological Impact Evaluation, Fort Devens, Massachusetts*. Prepared by TRC Environmental Corporation for MADEP. TRC conducted an ecological evaluation of Grove Pond and Plow Shop Pond and concluded that metals concentrations in sediments would likely impact ecological receptors.

[1]

33. February 1998. *Draft Five Year Review: Shepley's Hill Landfill Long Term Monitoring, Devens, Massachusetts.* Prepared by Stone & Webster Environmental Technology & Services for US Army Corps of Engineers, New England Division.

    Contains groundwater-monitoring results: groundwater elevations for 5 years; chemical data only for spring and fall 1997.

[3]

34. April 1998. Memo to J. Regan (MADEP) from S. Heim (TRC ecologist), Review of AVS/SEM Sampling Results, Grove Pond Sediment, Fort Devens, Massachusetts. Ten sediment samples from Grove Pond were collected and analyzed for acid-volatile sulfide and simultaneously extractable metals (AVS/SEM). All samples exceeded sediment criteria for Cr, and five samples

exceeded criteria for Pb. Samples with the highest metals concentrations came from locations near the tannery site, e.g. Cr at 24931 mg/kg; Pb at 437 mg/kg.
[1] [2]

35. August 1998: ATSDR consultation for Fish and Sediments. ATSDR concluded that residents of the Town of Ayer are not at risk due to limited exposure. A fish advisory went into effect, and Grove Pond was posted "Catch-and-Release."
[2]

36. August 1998. *Final 5 year Review- Shepley Hill Landfill.*
[1]

37. August 1998. *Evaluation of Health Concerns Associated with Drinking Water from Grove Pond Wells, Fort Devens, Ayer, Middlesex County, Massachusetts.* US Department of Health and Human Services, Public Health Service, ATSDR. In this consultation regarding groundwater from the Town of Ayer Grove Pond water-supply wells, ATSDR concluded that residents of the Town of Ayer are not at risk of exposure to harmful levels of metals from the water-supply wells, and future problems were not anticipated.
[2]

38. November 1998. *Surface Water & Sediment Sampling Fort Devens Superfund Site Ayer, MA.* Submitted to EPA by ESAT.
[1]

39. 1999. *USEPA Screening Level Ecological Risk Assessment, Fort Devens, Ayer, Massachusetts.* USEPA, Region 1 New England, Office of Environmental Measurement and Evaluation.

    Surface water and sediment samples were collected from Grove Pond, Plow Shop Pond, and Nonacoicus Brook.
[1] [3]

40. October 21, 1999. *Field Work and Analytical Results, PDC, Ayers.* Environmental Compliance Services (ECS) installed 5 MWs & 2 seepage meters at the PDC site (RTN 2-10138) and summarized the investigation in a memo format. Unknown if the investigation was performed for DEP or for privately. Included in the memo is: soil descriptions, gw elevations & analytical results for metals, PCBs, pesticides, EPH & SVOCs.
[1]

41. July 2000. *Phase II Subsurface Investigation, One Bligh Street, Ayer, Massachusetts.* Prepared for Nextel Communications by Sage Environmental. Two soil borings were sampled during installation of two groundwater-monitoring wells. Groundwater was analyzed for EPH, VOCs, PCBs, and 13 metals. Soils exceeded MADEP Method 1, S-2 standards for As and Hg. In groundwater, exceedances of the MCP Method 1, GW-2/GW-3 standard for Pb were found.

[1] [3]

42. July 2000. *Draft Shepley Hill Landfill Supplemental Groundwater Investigation.*

[1] [2]

43. September 2000. *Limited Environmental Investigation, Plastic Distribution Company, One Bligh Street, Ayer, Massachusetts.* Prepared by Environmental Compliance Services, Inc., for MADEP.

    MADEP Phase II investigation of Hartnett Tannery was completed in September 2000. Data from surface water, sediments, monitoring wells, soil borings, piezometers, and seepage meters are reported.

[1] [3]

44. September 2000. *Trace Element Exposure in Benthic Invertebrates from Grove Pond, Plow Shop Pond, and Nonacoicus Brook, Ayer, Massachusetts*. Prepared by US Fish and Wildlife Service for USEPA in response to a request by EPA for a limited screening-level contaminant study of mussels and crayfish. The investigators found As, Cd, Cr, and Hg in all mussel samples, and Hg in 9 samples out of 12. In crayfish, As, Cd, Hg, and Pb were not found to be elevated compared to results reported in scientific literature.

[1] [3]

45. September 2000. *RAM Plan for 30 Faulkner Drive, Ayer, MA.* Prepared by ENSTRAT Strategic Environmental Services for MADEP.

[1]

46. January 2001. *Data Report, Metals in Frog Tissue*. U.S. EPA Office of Environmental Measurement and Evaluation, Lexington, MA. February 2001.

    Frog tissue analyses are reported.

[1]

47. January 2001. *Study Area 71 Former Railroad Roundhouse Site, Various Removal Actions-Phase II, Devens, Massachusetts.* Prepared by Roy F. Weston for the U.S. Army Corps of Engineers.

    This is the final closure report. Under a separate report, the U.S. Army intends to perform a site-specific risk evaluation to support a No Further Action Decision.

[1] [2] [3]

48. April 2001. *Final Report Bioavailability and Potential Effects of Mercury and Selected Other Trace Metals on Biota in Plow Shop and Grove Ponds, Fort Devens, Massachusetts.* Prepared by T. A. Haines and J. R. Longcore (USGS) for EPA.

    Analyses of surface water, sediment, invertebrates, tree swallow tissues are reported.

[1]

49. April 2001. *RTC on Draft Shepley Hill Landfill Supplemental Groundwater Investigation*

[1]

50. May 2001. *Shepley Hill Landfill Long Term Monitoring and Maintenance – 2000 Annual Report.* Includes RTC on 1999 Annual Report.

[1]

51. August 2001. *Paleolimnological Assessment of Grove and Plow Shop Ponds, Fort Devens, Ayer, Massachusetts.* Prepared for USEPA by Norton, S.A. (University of Maine).

    In this study, cores from Grove, Plow Shop, and Spectacle Ponds were analyzed for stable Pb isotopes, and As, Cd, Cr, Hg, Ni, Pb, and Zn content. Conclusions state that high accumulation rates and elevated concentrations in Grove and Plow Shop Ponds indicate anthropogenic impact. The report also concluded that As is entering Plow Shop Pond from the southwestern side; Cd, Ni, Pb, and Zn enter the system from the eastern end of, or upstream of, Grove Pond; and Cr, Cu, and Hg come from the Tannery cove of Grove Pond.

[1] [3]

52. August 2001. *Semi-Annual Groundwater Analytical Data Report, Spring 2001, Shepley's Hill Landfill Long Term Monitoring, Devens, Massachusetts.* Prepared by Department of Army New England District, Corps of Engineers, Concord, Massachusetts

[1] [2]

53. January 2002. *Draft No Further Action Decision Under CERCLA, Study Area 71, Railroad Roundhouse, Devens Reserve Forces Training Area, Devens, Massachusetts.* Prepared for U.S. Army Corps of Engineers by Harding ESE, Inc..

    In this study, the human health & ecological risk evaluation is included.

[1]

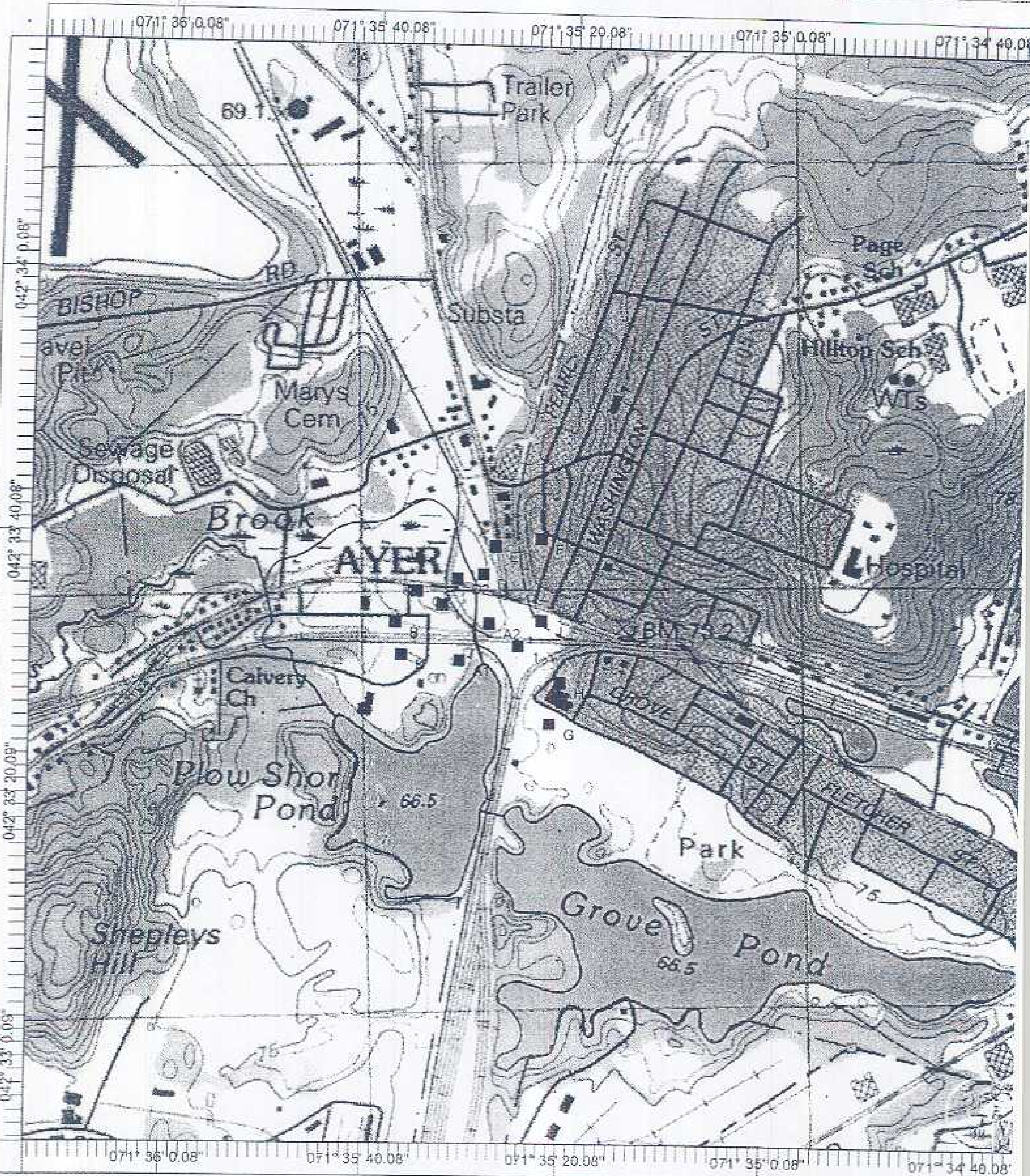
54. February 2002. *Revised Draft Shepley's Hill Landfill Supplemental Groundwater Investigation, Devens Reserve Forces Training Area, Devens, Massachusetts.* Prepared for U.S. Army Corps of Engineers by Harding ESE, Inc. – 2 volumes

[3]

55. May 1999 *Phase I Work Plan* through March 2002 *Grove Pond Arsenic Investigation* --- Phase I report (GF, 1999) includes data for metals, anions and alkalinity, and water quality parameters from 68 groundwater samples. Phase I activities involved only the Town of Ayer production wells, which were added to the Town water-supply system in July 1998; four existing monitoring wells (installed for a pump test in 1992) screened at the production horizon; two existing monitoring wells on MNG property; and eight surface water samples from Grove Pond. Arsenic was detected at low levels (< 10 μg/L) in surface waters and in the production wells at levels of ~20 to 30 μg/L. Phase II (GF, 2002) installed five new monitoring wells, with screen depths varying from the top of the water table to within bedrock. Close-interval sampling of soil and groundwater was conducted during installation of three of these monitoring wells and from a borehole in the pond, offshore from the production wells. Hydraulic characteristics were determined from slug tests performed during well installation and from grain-size analyses. Results show marked heterogeneity in the aquifer. Conductivity is generally lower in the upper 40 feet of the aquifer, due to higher silt content, and higher through the sand-gravel interval in which the Town wells are screened. Groundwater chemistry is also consistent with the hydraulic properties of the aquifer. The upper ~40 feet are characterized by low oxidation-reduction potential (ORP); below ~45 feet, ORP is positive (through the screened interval) but becomes reducing again near and into bedrock. Dissolved arsenic increases with depth in the upper 40 feet, to a maximum of 189 μg/L around 45 feet below ground surface, and drops to levels near detection limits below this depth. The correlation between groundwater ORP, arsenic, and iron points strongly toward reductive dissolution of ferric oxyhydroxide coatings on aquifer material, with subsequent release of sorbed constituents, as the mechanism responsible for the observed arsenic in the Town wells. The ultimate arsenic source has been tentatively attributed to arsenic-bearing sulfide minerals (pyrite and cobaltite), which have been identified in samples of bedrock from beneath these wells. Glacial and post-glacial physical and mechanical weathering of these sulfide phases is postulated to have resulted in the present-day distribution of arsenic and other metals through the aquifer.

56. Data from U.S. EPA investigations in 2004 and 2005. Grove Pond data included 6 surface water samples (total and dissolved metals, pesticides/PCBs), 15 sediment samples (metals), 3 sediment samples (metals, pesticides/PCBs, and PAHs), 4 fish samples (metals and pesticides/PCBs), and toxicity data for surface water invertebrates, benthic invertebrates, and fish. Plow Shop Pond data included 10 surface water samples (total and dissolved metals, pesticides/PCBs),

28 sediment samples (metals), 11 sediment samples (metals, pesticides/PCBs, and PAHs), 4 fish samples (metals and pesticides/PCBs), and toxicity data for surface water invertebrates, benthic invertebrates, and fish. Flannagan Pond data included 1 surface water sample (total and dissolved metals, pesticides/PCBs), 2 sediment samples (metals, pesticides/PCBs, and PAHs), 3 fish samples (metals and pesticides/PCBs), and toxicity data for surface water invertebrates, benthic invertebrates, and fish.



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G - 042° 33' 25.7" N, 071° 35' 21.4" W
A1 - 042° 33' 30.6" N, 071° 35' 30.8" W
A2 - 042° 33' 33.4" N, 071° 35' 27.8" W
B - 042° 33' 33.4" N, 071° 35' 37.3" W
C - 042° 33' 35.8" N, 071° 35' 35.1" W
E - 042° 33' 39.3" N, 071° 35' 27.2" W
F - 042° 33' 39.9" N, 071° 35' 22.5" W
1 - 042° 33' 31.7" N, 071° 35' 24.7" W
1 - 042° 33' 31.7" N, 071° 35' 24.7" W
I - 042° 33' 34.8" N, 071° 35' 32.6" W
J - 042° 33' 33.7" N, 071° 35' 22.4" W
K - 042° 33' 30.9" N, 071° 35' 36.7" W
D2 - 042° 33' 36.8" N, 071° 35' 31.1" W
D - 042° 33' 37.2" N, 071° 35' 28.4" W

Name: AYER
Date: 11/9/101
Scale: 1 inch equals 1000 feet

Location: 042° 33' 35.4" N 071° 35' 23.9" W

SANBORN MAP REVIEW
GROVE AND PLOW SHOP PONDS
General Services Agreement

1949 SANBORN MAP

1: B&M Rail Road Passenger Station and freight house located to the east-northeast of Plow Shop Pond.

A1: G.V. Moore Lumber Company located to the northwest of Plow Shop Pond, property abuts the ponds edge.

A2: G.V. Moore Lumber Company located to the north of Plow Shop Pond along the north side of the railroad tracks. This property lies along the eastern and western banks of a tributary draining into Plow Shop Pond.

B: Cabinet Manufacturer located to the northwest of Plow Shop Pond on Shirley Street.

C: Plastic Goods Storage located to the northwest of Plow Shop Pond on Mechanic Street.

D: E.O. Proctor Garage (repair shop) with attached movie theater to the north and photo shop to the east. Located to the north of Plow Shop Pond along the north side of West Main Street along the east bank of an un-named tributary draining into Plow Shop Pond.

E: Coal Yard Farm Service Company located to the north of Plow Shop Pond.

F: Chandler Machine Company located to the northeast of Plow Shop Pond.

G: Ayer Tanning Company, Inc. located to the east of Plow Shop Pond and north of Grove Pond.

H: International Purchasing Company Rope Storage. North of the tannery on Bleigh Road facility consists of three main buildings including a paper pulp storage building.

J: Paint Tin Shop located to the north of Plow Shop Pond

K: Vacant

*The area to the north of Grove Pond and west of School and Flannagan Ponds is primarily residential.

SANBORN MAP REVIEW
GROVE AND PLOW SHOP PONDS
General Services Agreement

1921 SANBORN MAP

1: B&M Rail Road Passenger Station and freight house located to the east-northeast of Plow Shop Pond.

A1: L.W. Phelps Sawmill – Upper Mill located to the northwest of Plow Shop Pond, property abuts the ponds edge.

A2: L. W. Phelps Wooden Box Factory – Lower Mill located to the north of Plow Shop Pond along the north side of the railroad tracks. This property lies along the eastern and western banks of an un-named tributary draining into Plow Shop Pond.

B: Data unclear on Sanborn Map but appears to have changed from a cabinet manufacturer to a wholesaler of some type.

C: ARMY YMCA Main Hall located to the northwest of Plow Shop Pond on Mechanic Street.

D: E.O. Proctor Garage (repair shop) in a plaza with a movie theater to the north. Located to the north of Plow Shop Pond along the north side of West Main Street along the eastern bank of an un-named tributary draining into Plow Shop Pond.

E: J. Cushing Coal Yard located to the north of Plow Shop Pond.

F: Unoccupied building "to be a machine shop".

G: Eugene Barry and Sons Tannery located to the east of Plow Shop Pond and north of Grove Pond.

H: Ayer Machine Tool Company (not in operation) located north of the tannery on Bleigh Road.

K: Faye Phipps Company Wholesale Hardware.

* The area to the north of Grove Pond and west of School and Flannagan Ponds is primarily residential.

SANBORN MAP REVIEW
GROVE AND PLOW SHOP PONDS
General Services Agreement

1912 SANBORN MAP

1: B&M Rail Road Passenger Station and freight house located to the east-northeast of Plow Shop Pond.

A1: L.W. Phelps Sawmill – Upper Mill located to the northwest of Plow Shop Pond, property abuts the ponds edge.

A2: L. W. Phelps Box Factory – Lower Mill located to the north of Plow Shop Pond along the north side of the railroad tracks. This property lies along the eastern and western banks of an un-named tributary draining into Plow Shop Pond.

B: Vacant lot.

C: Vacant lot.

D: Small un-named garage and maintenance shop along the eastern bank of an un-named tributary draining into Plow Shop Pond.

D2: Fredrick Whitney Carriage House (with paint or print shop unclear on map).

E: A.E. Lawrence and Sons Coal Shop located to the north of Plow Shop Pond.

F: Vacant lot.

G: Eugene Barry and Sons Tannery located to the east of Plow Shop Pond and north of Grove Pond.

H: Chandler Company Manufacturer of special machinery located north of the tannery on Bleigh Road.

I: Standard Oil Co. Depot south of Shirley Street.

J: Tobacco shop and restaurant on Merchants Way, north of Plow Shop Pond.

K: Hayhes Piper Company Cider Manufacturer located to the east of L.W. Phelps Lower Mill.

* The area to the north of Grove Pond and west of School and Flannagan Ponds is primarily residential.

SANBORN MAP REVIEW
GROVE AND PLOW SHOP PONDS
General Services Agreement

1902 SANBORN MAP

* *The 1902 Sanborn Map shows Plow Shop Pond extending further north almost to the railroad tracks (prior to filling of the pond). This map also identifies the tributary leading to Plow Shop Pond from the north as Nanacanicus Brook.*

1: B&M Rail Road Passenger Station and freight house located to the east-northeast of Plow Shop Pond.

A1: L.W. Phelps Sawmill – Upper Mill located to the northwest of Plow Shop Pond, property abuts the ponds edge (waste shed on the banks of the pond). Also, K + C Manufacturer Company – manufacturers wood rims for bicycles and automobiles building located to the east of L.W. Upper Mill.

A2: L. W. Phelps Box Factory – Lower Mill located to the north of Plow Shop Pond. This property lies along the eastern and western banks of Nanacanicus Brook. North of L.W. Lower Mill is E.O. Proctor Machine Shop and Bicycle Repair.

B: Fitchburg Rail Road Round House.

C: Vacant lot.

D: Vacant lot.

D2: Fredrick Whitney Carriage House.

E: Carriage Farm.

G: Eugene Barry and Sons Tannery located to the east of Plow Shop Pond and north of Grove Pond.

H: Chandler Company, manufacturer of special machinery and Ayer Preserving Company located further north on Bleigh Street.

I: J. T. Pillman Preserve Co. located along the west side of Nanacanicus Brook.

* The area to the north of Grove Pond and west of School and Flannagan Ponds is primarily residential. Also, the Nashoba Manufacturer of DyeInc Mordant was located somewhere along the western banks of Plow Shop Pond (near a wooden bridge) the exact location could not be determined from the map.

SANBORN MAP REVIEW
GROVE AND PLOW SHOP PONDS
General Services Agreement

1897 SANBORN MAP

** Both Plow Shop and Grove Ponds were identified on this map as Tannery Pond.*

1: B&M Rail Road Passenger Station with freight house and coal sheds are located to the east-northeast of Plow Shop Pond.

A1: L.W. Phelps Sawmill – Upper Mill located to the northwest of Plow Shop Pond, property abuts the ponds edge (waste shed on the banks of the pond). Also, Chris H. Moulton Shoe factory was located to the east of L.W. Upper Mill.

A2: L. W. Phelps Box Factory – Lower Mill located to the north of Plow Shop Pond along the north side of the railroad tracks. This property lies along the eastern and western banks of Nanacanicus Brook.

B: Fitchburg Rail Road Round House.

C: Vacant lot.

D: Vacant lot.

D2: Fredrick Whitney Carriage House.

E: Carriage House.

G: Alley Brothers Place Tannery located to the east of Plow Shop Pond and north of Grove Pond.

H: Ayer Foundry Company. Northeast of the foundry was Sigsbeen Company and E.O. Proctor Machine Shop all located north of the tannery on Bleigh Road.

I: Whitcher Pillman Company Preserves Manufacturer located along the west side of an un-named tributary to Plow Shop Pond.

K: W.J. Piper Company Vinegar Manufacturer.

* Area to the north of Grove Pond and west of School and Flannagan Ponds is primarily residential. Also, the Nashoba Manufacturer of DyeInc Mordant was located somewhere along the western banks of Plow Shop Pond (near a wooden bridge) the exact location could not be determined from the map.

SANBORN MAP REVIEW
GROVE AND PLOW SHOP PONDS
General Services Agreement

1892 SANBORN MAP

**Both Plow Shop and Grove Ponds were identified on this map as Tannery Pond*

I: B&M Rail Road Passenger Station with freight house and coal sheds located to the east-northeast of Plow Shop Pond.

A1: L.W. Phelps Sawmill – Upper Mill located to the northwest of Plow Shop Pond, property abuts the ponds edge (waste shed on the banks of the pond). Also, Chris H. Moulton Shoe factory was located to the east of L.W. Upper Mill.

A2: L. W. Phelps Lumber Yard located to the north of Plow Shop Pond along the north side of the railroad tracks. This property lies along the eastern and western banks of an un-named brook.

B: Fitchburg Rail Road Round House.

C: Vacant lot.

D: Vacant lot.

D2: Fredrick Whitney Carriage House.

E: Carriage House.

G: Alley Brothers Place Tannery located to the east of Plow Shop Pond and the north of Grove Pond.

H: D.L. G. H Chandler Foundry.

I: Vacant lot.

K: W.J. Piper Company Vinegar Manufacturer.

*Area to the north of Grove Pond and west of School and Flannagan Ponds is primarily residential.

SANBORN MAP REVIEW
GROVE AND PLOW SHOP PONDS
General Services Agreement

1887 SANBORN MAP

** Both Plow Shop and Grove Ponds were identified on this map as Tannery Pond and the tributary was identified as Moss Brook.*

1: B&M Rail Road Passenger Station with freight house and coal sheds located to the east-northeast of Plow Shop Pond.

A1: No coverage.

A2: L. W. Phelps Saw Mill and Ayer Furniture Company. These properties lie along the eastern and western banks of Moss Brook.

B: Fitchburg Rail Road Round House.

C: Vacant lot.

D: Vacant lot.

D2: Fredrick Whitney Carriage House.

E: Furniture Store.

G: Alley Brothers Place Tannery located to the east of Plow Shop Pond and north of Grove Pond.

H: Briggs and Kelly Foundry and Machine Shop.

* The area to the north of Grove Pond and west of School and Flannagan Ponds is primarily residential.

APPENDIX B
ANALYTICAL DATA

FINAL

HUMAN HEALTH RISK ASSESSMENT

GROVE POND AND PLOW SHOP POND

AYER, MASSACHUSETTS

May 2006

Prepared for:

USEPA Region 1
Contract EP-W-05-020 Task Order #01

Prepared by:

Gannett Fleming, Inc.
207 Senate Avenue
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TABLE OF CONTENTS

1.0 INTRODUCTION

The U.S. Environmental Protection Agency (USEPA) directed Gannett Fleming, Inc. (Gannett Fleming) to prepare this Human Health Risk Assessment (HHRA) Report as part of the Grove and Plow Shop Ponds Expanded Site Investigation (ESI). This report is in response to the Task Order #01 to Contract EP-W-05-020, Remedial Oversight of Activities at Fort Devens Plow Shop and Grove Ponds. The objective of the human health risk assessment is to provide a quantitative estimate of risk posed to humans potentially exposed to Grove Pond and Plow Shop Pond. The location of this site is shown on Figure 1.

To assess potential public health risks, three major aspects of chemical contamination and exposure must be considered: 1) the presence of chemicals with toxic characteristics; 2) the existence of pathways by which human receptors may contact site-related chemicals; and 3) the presence of human receptors. The absence of any of these three aspects would result in an incomplete exposure pathway and an absence of quantifiable risk.

The human health risk assessment consists of five major components:

- Hazard Identification : Evaluate data usability, data quality and select contaminants of potential concern (COPC) (Section 2.0)
- Exposure Assessment: Identify potential receptor populations and completed exposure pathways. Determine exposure point concentrations for all COPCs, and present exposure equations and input parameters to be used to estimate chemical intakes (Section 3.0)
- Dose-Response Assessment: Identify chemical-specific toxicity criteria to be used for quantifying potential human risks. (Section 4.0)
- Risk Characterization: This section presents methods for calculating noncarcinogenic and carcinogenic risks for each receptor and provides summaries of the results of the site-specific risk evaluations. (Section 5.0)
- Uncertainty Analysis: Discuss both inherent and study-specific uncertainties in the risk assessment process and potential impacts on risk assessment conclusions. (Section 6.0)

The HHRA was performed following standard USEPA guidelines including the following documents:

- *Risk Assessment Guidance for Superfund (RAGS)*, *Volume I, Part A* (USEPA, 1989)
- *RAGS, Volume I, Part D* (USEPA, 1998)
- *RAGS, Volume I, Part E, Dermal Risk Assessment Interim Guidance* (USEPA, 2004)
- *Standard Default Exposure Factors* (USEPA, 1991)
- *Exposure Factors Handbook* (USEPA, 1997a)
- *Calculating Upper Confidence Limits for Exposure point Concentrations at Hazardous*

Waste Sites (USEPA, 2002)
- *Supplemental Guidance to RAGS: Region 1 Risk Updates 1 through 5*

Additional guidance was obtained from Massachusetts Department of Environmental Protection (MADEP) (MCP 1994, 1995, 1996a,b, 1997, 1988, 1999, 2000, 2002a,b,c) to supplement USEPA guidance. A complete list of references for the human health risk evaluation is provided at the end of this chapter. The majority of the tables to be included in this section are analogous to the standard tables required by the recent Risk Assessment Guidance for Superfund: Part D (RAGS Part D) (USEPA, 1998). Data fields to be included in the tables presented in this risk assessment include the majority of data fields specified in the RAGS Part D guidance. The five human health risk assessment components are presented in the following sections.

2.0 HAZARD IDENTIFICATION

The goal of the hazard identification step is to develop a list of chemicals of potential concern (COPCs) for each environmental medium under consideration. Data for the human health risk assessment were obtained from a number of studies. Data were evaluated for data quality, data validation procedures were reviewed for historical data or performed for 2004-2005 data and suitable data were then compiled into a data set to be used for identification of COPCs.

2.1 Data Evaluation

For the Grove Pond site, data evaluation was performed in two stages. As part of the *Data Gap Evaluation Report* (Gannett Fleming, 2002) investigations of the study area and surrounding properties were evaluated for data quality. The majority of the reports were obtained from the BRAC library located at Fort Devens. Other sources of reports included the MADEP Central Regional office and the Town of Ayer public library. Approximately 55 documents were acquired and are maintained in the Gannett Fleming library in Newton, Massachusetts. A listing of these documents with brief descriptions is included in Appendix D of the *Data Gap Evaluation Report* (Gannett Fleming, 2002). The historical data considered for use in this HHRA were obtained from studies deemed useable for risk assessment in the *Data Gap Evaluation Report* (Gannett Fleming, 2002). Subsequent to the development of the *Data Gap Evaluation Report* (Gannett Fleming, 2002), supplemental samples were collected in 2004 and 2005 to address data gaps previously identified. Data used in this human health risk assessment represent a compilation of the historical data identified as suitable for use in the *Data Gap Evaluation Report* (Gannett Fleming, 2002) and the data collected as part of the Expanded Site Investigation (ESI) by Gannett Fleming in 2004 and 2005.

For the historical data, the laboratory analytical data were reviewed for data quality and usability for this risk assessment (DURA). The DURA process, a multi-step process designed by USEPA (1989) and (1992 a,b) involves assessing overall data quality and the usability of data for performing a quantitative risk assessment and selection of COPCs for the human health risk assessment (HHRA) . However, because the majority of the reports used for database input did not include laboratory analytical reports, it was not possible to complete all the formal DURA steps for the HHRA.

Some historical reports lacked analytical reports for each sample. However, the data were deemed usable owing to the original source (usually the US Army Environmental Center) and purpose (data were collected to support Remedial Investigations for this area). Where analytical reports were not available, summary tables found within the reports were used to compile results. In some cases, contaminant concentrations from summary tables represented laboratory method detection limits; however, if there were no notes in the summary tables indicating detection limits, the concentration was entered into the database.

Due to the absence or availability of original laboratory data, the data evaluation process for historical data was truncated to two major steps with the overall objective being to ensure data of sufficient quality to be used to assess potential risks to human health. Simplified, the data evaluation process was performed to two steps:

1) Gather all data available from the site investigation and sort by medium, and

2) Validate and evaluate the data submitted by the laboratory to evaluate acceptability for use in the human health risk assessment. The following section discusses the data validation evaluation.

2.2 Data Validation

The purpose of the validation review that was conducted as part of the *Data Gap Evaluation Report* (Gannett Fleming, 2002) was to evaluate the general quality of each data set and to determine the usability of the data for the HHRA. Many reports were used to assemble the analytical database. These reports were reviewed to determine and evaluate:

1. The level of data validation or review performed at the time the data were generated,
2. The analytical protocols and laboratories utilized, and
3. The availability of Quality Assurance (QA) and Quality Control (QC) information.

The review conducted was similar to an USEPA Region 1 Tier 1 data validation (USEPA, 1996d) review in that one of the goals was to determine whether there was enough information provided to conduct a higher level of data validation, if desired. Review of actual QA/QC data (matrix spike recoveries, etc.) was not performed during this evaluation, nor were any data qualifiers assigned.

The analytical data were generated over a period of 10 to 11 years, by various laboratories, and for many different reasons and entities. The documentation available for each of the data sets is as varied as the sources. It should be noted that none of the data appears to have undergone formal data validation as per USEPA data validation guidelines (USEPA, 1996d). In order to be able to justify combining any of these data sets, minimum usability criteria were implemented to complete this review. Data were determined to be usable for HHRA purposes under the following conditions:

1. USEPA-approved or equivalent laboratory methods were used,
2. Data were generated by an USEPA laboratory or under the Army Corp of Engineers analytical and review protocols,
3. Enough QA/QC information was provided in the report to perform a Tier II level data validation at some future time, or
4. USEPA had already reviewed and accepted the data.

If none of the above conditions were met, the data set was assigned a "Not Acceptable" data usability code for use in the HHRA. As demonstrated in the *Data Gap Evaluation Report* (Gannett Fleming, 2002) the vast majority of the historical data were determined to be usable for characterizing the nature and extent of contamination based on the minimum usability criteria. However, not all data were considered usable in the human health risk assessment for various reasons. For example, the human health risk assessment does not utilize data from samples that were field filtered or collected to support ecological studies. For more detail regarding the quality and usability of the historical data can be found in the *Data Gap Evaluation Report, Appendix G* (Gannett Fleming, 2002).

2.3 Data Compilation

The historical analytical data and the data collected as part of the ESI were subdivided into two study areas to assist in risk management decisions. The study areas are Grove Pond and Plow Shop Pond.

The scope of this project has been limited to pond-related media only. This decision was reached through discussions with the USEPA and as specified in the USEPA Task Request for this project (Contract EP-W-05-020 Task Order #01). While groundwater has been collected at the site, risks associated with this medium will not be included in the HHRA as there is no direct exposure to groundwater in the pond area. The primary purpose of evaluating groundwater in the ESI was to assess the impacts of groundwater discharges to the ponds. Because the surface water and sediment are included in the HHRA for risk quantification, the impacts of groundwater to surface water and sediment are being addressed indirectly. Soil was also not evaluated as part of the HHRA. After considerable discussion, it was decided that soils adjacent to the pond would not be considered as pond-related media.

The media of concern considered in this HHRA include:

- Surface water

- Sediment, and
- Fish tissue

All surface water samples, which passed the data evaluation, were included in this risk assessment. The decision to use all surface water samples was based on the fact that a receptor may potentially contact any point of surface water in the pond from a boat. In addition, surface water mixes over time and therefore, it would be appropriate to develop exposure point concentrations based on all samples collected. However, further consideration was needed regarding the appropriate subset of data to use for sediment and fish tissue.

For sediments, two possible data sets were considered for use: all sediment sampling points and a subset of data sampling points identified as near-shore sediments. It was decided that while sediment samples were collected throughout both ponds, the sediments most likely to be available for exposure on a routine basis are those located within the near shore area. The near-shore sediment area is defined as the area reaching approximately 75 feet into each pond, as shown on Figure 2. If wading were to occur, it is likely, given the mucky consistency of the sediments and the density of the vegetation, that a receptor would not wade farther into the pond than 75 feet from shore. The selection of this area for evaluation does represent an uncertainty and a comparison of analytical results between all sediments and near shore sediments is presented in the uncertainty section of this risk assessment. A comparison of the near shore sediment results to all sediment results is presented in Table 2-1.

Fish tissue results were available for fillet samples and whole body samples. Typically, analytical results from fillet samples are used in a human health risk assessment since humans primarily consume fish fillets rather than whole fish (USEPA 1997a). Although the results for fish fillets were somewhat old (data were from the early 1990s), the differences between fillet results and whole body results were great enough that it would not have been appropriate to combine fillet and whole fish data (see Table 2-2 and Table 2-3). As can be seen in Table 2-2 detection frequencies are similar in Grove Pond fish between fillets (60% detected) and whole body (64% detected) but, as shown in Table 2-3, were lower in fish from Plow Shop Pond fillets (33% detected) compared to whole body results (52% detected). Of possibly greater importance, it appears that concentrations in fillet samples were most commonly four times lower in fillets than in whole body samples (see Figure 3 and Tables 2-2 and 2-3). Thus, the use of whole body samples, given that the fish ingestion habits of humans are relatively well defined and do not include ingestion of whole fish, would likely have resulted in a high bias to the risk results. To avoid this possible inaccuracy, only fish fillet results have been used in this human health risk assessment. The ramifications of the selection of the fillet data only for use in the quantitative risk assessment will be further discussed in the uncertainty section.

Table 2-4 presents a summary of all samples used in the risk assessment for sediment, surface water and fish tissue media in Grove Pond and Plow Shop Pond. The citations for the studies from which historical data were obtained are also presented in this table.

2.4 Selection of Chemicals of Potential Concern

This section presents the selection of Chemicals of Potential Concern (COPC) for all environmental media utilized in the human health risk assessment. The selection of COPC was conducted in accordance with USEPA (1989, 1994) guidance. The process is designed to narrow the focus of the risk assessment to those contaminants that may pose a threat to human health. The criteria used to limit the list of contaminants for future consideration is described below.

Selection Criteria

Several steps were involved in identifying COPCs for further risk analysis.

Risk-Based Screening. Contaminants were screened against risk-based screening concentrations in order to further focus the risk assessment on the compounds that may have a toxic effect on human receptors. Concentrations of chemicals which are below their respective risk-based screening value were not retained for further evaluation in the risk assessment. USEPA Region 9 Preliminary Remediation Goals (PRGs) were used as the human health screening criteria (USEPA Region 9, 2004). The PRGs are screening values that are compiled by using toxicity information to calculate contaminant concentrations that will result in a Hazard Index of 1 or an excess lifetime cancer risk or 1 E-6. If a contaminant has both carcinogenic and non-carcinogenic toxic effects, the lower concentration was selected. In accordance with USEPA Region 1 guidance, PRG values for noncarcinogens were divided by 10 in order to account for the potential additive noncarcinogenic effects. The PRG values available online at the USEPA Region 9 website were used to screen the data in the database. If screening values were not available, the screening value of a similar chemical was used as a surrogate screening value, if appropriate. Values from surrogate chemicals used in the COPC screening process are listed in all RAGS D Table 2s.

Surface water concentrations detected in the study area were screened versus tap water PRG values. Sediment concentrations detected in the study area were screened versus residential soil PRG values. Because USEPA Region 9 has not published PRGs for fish tissue, USEPA Region 3 risk-based concentrations (RBCs) for fish tissue were used (USEPA Region 3, 2005). No comparison to background concentrations was performed.

Frequency of Detection. Chemicals may be deleted from further consideration in the risk assessment if they are infrequently detected (USEPA, 1989) or if the infrequent detection is shown not to be indicative of a “hot spot.” Contaminants detected infrequently at high concentrations are typically indicative of a hot spot, or highly localized area of contamination. Hot spot data should be evaluated in the risk assessment and are not eliminated from further consideration. However, contaminants detected infrequently and at low concentrations may be an analytical artifact and should not be carried through the risk assessment. Typically, a detected contaminant in less than 5% of at least 20 samples at a low concentration may be considered for removal from further consideration in the risk assessment, provided that the contaminant is not expected to be present based upon historic activities in the site.

Nutrients. Essential human dietary nutrients were eliminated as COPC. USEPA guidance considers calcium, chloride, iodine, magnesium, phosphorous, potassium and sodium, as essential nutrients. These essential nutrients were not retained for further evaluation in the risk assessment. However, the effect of omitting these chemicals from the quantitative risk analysis is discussed in the uncertainty section of this report.

Lead. In the case of lead, insufficient information exists to develop risk-based screening values. Therefore, the USEPA screening value (USEPA, 1994a) of 400 mg/kg was used to screen soils and sediments. This screening value was selected in accordance with USEPA Region 1 guidance (USEPA, November 1996). No screening was performed for lead found in surface water or fish fillet samples.

Re-inclusion of COPCs. RAGS A discusses the need for a potential reinclusion step during the COPC screening process. Constituents screened may need to be re-included as a COPC for a variety of reasons. For this risk assessment, if one carcinogenic polynuclear aromatic hydrocarbon (PAH) was retained during COPC screening then all carcinogenic PAHs were included as COPCs. Carcinogenic PAHs derive their toxicity from equivalency factors based on the toxicity of benzo(a)pyrene. Therefore, the effects of all carcinogenic PAHs are additive and it is not appropriate to evaluate only a subset of the carcinogenic PAHs present.

The results of the screening process are presented in Tables 2-5 through 2-10. Metals, PAHs, PCBs and DDT/DDD/DDE have been identified as the primary COPCs in surface water, sediment, and fish tissue.

Data Management

In developing a data set for COPC screening, several data management decisions were needed in order to process the data. Field duplicates were screened on the maximum value of a duplicate pair. For development of average concentrations for the data set, the duplicates values were averaged then input as a single result. This procedure prevents over representing a single location.

Elevated nondetected values can result if the sample requires dilution. Sample dilutions may be needed owing to matrix interference or if one constituent is present at a greatly elevated concentration. If a nondetected value exceeded two times the maximum the nondetected value was not used in the data set. This procedure was used to avoid the situation where the maximum value was not an actual detected value but rather a diluting-derived nondetected result.

3.0 EXPOSURE ASSESSMENT

Exposure is defined as the contact of a receptor with a chemical or physical agent (USEPA 1989). An exposure assessment is the determination or estimation (qualitative or quantitative) of the magnitude, frequency, duration, and route of exposure. An exposure assessment is composed of the following steps:

- Characterization of the environmental setting (Section 3.1)
- Summary of the nature and extent of contamination (Section 3.2)
- Identification of potential receptors and exposure pathways (Section 3.3)
- Estimation of exposure concentrations (Section 3.4)
- Estimation of chemical intakes (Section 3.5)

3.1. Characterization of the Environmental Setting

A summary of the specific aspects of the environmental setting, as they relate to the human health risk assessment, is presented below. Characterization of the physical setting includes current land uses and characteristics of site with regard to the human health risk assessment. The purpose of this discussion is to identify media that human receptors may contact while at Grove Pond or Plow Shop Pond and provide a general understanding of the human exposure setting.

Grove Pond

Grove Pond is roughly triangular in shape and covers about 60 acres. The northern shore includes the location of the Plastic Distributing Company (PDC, location of former tannery operations), Pirone Park owned by the Town of Ayer, and residential properties. The southeastern shore is bordered by property owned by the Town of Ayer. The southern shore is also bordered by property owned by Fort Devens. Within this area are Devens' water supply wells, which are currently active with treatment**.** Immediately beyond the Devens' shoreline is the Massachusetts National Guard. The western edge of the pond is formed by the railroad causeway, owned and operated by Guilford Transportation (formerly Boston & Maine Railroad, B&MRR).

Grove Pond is shallow, with maximum water depth approximately 5 to 6 feet, and the water is frequently eutrophic, or well nourished by aquatic plant nutrients. The pond bottom consists largely of a thick mat of decomposing vegetation. Grove Pond receives drainage from Balch Pond, as well as from Cold Spring Brook and Bowers Brook, and discharges through a culvert on the western edge of the pond into Plow Shop Pond. Cold Spring Brook is downgradient of Devens. Bowers Brook connects into Cold Spring.

Recreational features of the pond include a playground, a boat ramp with use restrictions and "Catch and Release" fishing. The area is designated "Catch and Release" for recreational fishing. However, witnesses have observed the local population retaining caught fish, presumably for consumption. Expected recreational activities would include fishing and wading. Dense vegetation typically present on the pond surface would make Grove Pond unattractive for swimming. There are water supply wells and a water treatment plant adjacent to Grove Pond at the southern end.

Plow Shop Pond

Plow Shop Pond is located downstream and to the west of Grove Pond. Surface water flows from Grove Pond to Plow Shop Pond through a culvert. Plow Shop Pond is also a shallow pond and is approximately 30 acres. The central portion of the pond is approximately 8 feet deep, and the deepest portion of the pond is reported to be at the northeast arm of the pond. The water level is controlled by a dam located at the northwest corner of the pond where it forms Nonacoicus Brook and its associated wetlands, which in turn flows approximately 1.5 miles northwest into the Nashua River. Plow Shop Pond is similar to Grove Pond in regards to the aquatic community; however, Plow Shop Pond is smaller and slightly deeper, and the aquatic vegetation tends to be less dense than Grove Pond. (USFW, September 2000)

The northern shore of Plow Shop Pond is bordered by commercial businesses. The eastern shore is the Guilford Transportation railroad causeway. The southern and western shores include the former railroad roundhouse, and woodland and grassland associated with Shepley's Hill Landfill.

Plow Shop Pond is used recreationally for fishing. Dense vegetation typically present on the pond surface would make Plow Shop Pond unattractive for swimming. There are no residences along the pond shore nor are any water supply wells located along Plow Shop Pond. The area is designated "Catch and Release" for recreational fishing. However, witnesses have observed the local population retaining caught fish, presumably for consumption.

3.2 Summary of the Nature and Extent of Contamination

Both the Grove Pond and Plow Shop Pond surface water and sediments were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), metals, PCBs and pesticides. The ESI Report describes in detail the nature and extent of contamination for these classes of compounds therefore, a brief summary is presented here to provide a general perspective of contaminant distribution in these ponds.

Grove Pond

The analytical results for the Grove Pond sediments indicate that the most frequently analyzed and detected class of chemicals included metals, followed by pesticides and PCBs (i.e. primarily DDD, DDE, and DDT). SVOCS and VOCs were the most infrequently detected compounds.

In surface water the most widely and frequently detected class of compounds were metals. The SVOC bis(2-ethylhexyl)phthalate was also detected. This constituent is a common laboratory contaminant. Although this constituent was not flagged as blank qualified during data validation, it is possible that its presence is related to lab-based contamination rather than from a release of hazardous material into surface water. This is likely given the relatively low solubility of bis(2-ethylhexyl)phthalate in water.

Constituents found in fish include metals, PCBs and DDD/DDE.

Plow Shop Pond

The analytical results for the Plow Shop Pond sediments indicate that the most frequently analyzed and detected class of chemicals included metals, followed by polycyclic aromatic hydrocarbons (PAHs). Pesticides, VOCs and PCBs were the most infrequently detected compounds found only at concentrations which did not exceed screening values.

In surface water the most widely and frequently detected class of compounds were metals followed by detections of two VOCs (i.e., likely laboratory artifacts) and one pesticide.

Metals and DDE were the major constituents detected in fillet portion of fish from Plow Shop Pond.

Summary of Conceptual Site Model Development for Arsenic, Cadmium, Chromium, Mercury and Lead

Section 5.0 of the ESI Report presents the fate and transport analysis and conceptual site model for the sources of arsenic, cadmium, chromium, mercury and lead in Grove Pond and Plow Shop Pond sediments. The results of this section are paraphrased below.

- Arsenic levels were found to be elevated in sediments from both Grove Pond and Plow Shop Pond. The source for the arsenic was concluded to be accumulation from groundwater discharge, with elevation in Red Cove sediment probably owing to reduced groundwater from the direction of Shepley's Hill Landfill.
- Cadmium levels were determined to be elevated in sediments but no-pond related source was identified. General anthropogenic input was determined to be the likely source of elevated cadmium in sediments.
- Chromium levels were found to be elevated in sediments from both Grove Pond and Plow Shop Pond. The levels were strongly attributed to waste discharges from the former tannery located on the northwestern shore of Grove Pond.
- Mercury levels were determined to be elevated in sediments from both Grove Pond and Plow Shop Pond. Also, elevated mercury concentrations were correlated with elevated chromium concentrations.
- Lead levels were not found to be elevated in sediments on a pond-wide bases for either pond. However, sediment concentrations of lead were found to be locally elevated in the Tannery Cove in Grove Pond and adjacent to the former railroad roundhouse in Plow Shop Pond.

3.3 Estimation of Exposure Point Concentrations

According to USEPA guidance (December 1989, May 1992, September 1995, December 2002), risk assessments are conducted using a representative Exposure Point Concentration (EPC). For this risk assessment, Exposure Point Concentrations (EPCs) were calculated for COPCs only.

Ideally, the EPC should be the true average concentration within the exposure unit. The true population mean concentrations of the COPCs at a contaminated site are often unknown, and are frequently estimated by the respective sample means based upon the data collected from the site under investigation. In order to address the uncertainties associated with the estimates of the true unknown mean concentrations of the COPCs, appropriate 95% upper confidence limits (UCLs) of the respective unknown means are frequently used in many environmental applications. The computation of an appropriate 95% UCL of practical merit depends upon the data distribution and the skewness associated with the data set under study. The USEPA program ProUCL can be used to compute an appropriate UCL of the unknown population mean using a discernible probability distribution (e.g., normal, lognormal, gamma) and/or a suitable non-parametric distribution-free method.

In December 2002, the USEPA revised the Guidance Document to Calculate the Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites (OSWER 9285.670). ProUCL, Version 3.0 consists of all parametric and non-parametric UCL computation methods as described in this revised USEPA UCL Guidance Document.

ProUCL computes parametric UCLs based upon a normal, lognormal, and a gamma distribution. ProUCL also computes UCLs using several nonparametric methods. The computation of an appropriate UCL of the unknown population mean depends upon the data distribution, therefore goodness-of-fit tests need to be performed to assess the data distribution before using one of the UCL computation methods available in ProUCL. Based upon an appropriate data distribution and the associated skewness, ProUCL provides recommendations about one or more 95% UCL computation methods that may be used to estimate the unknown mean concentration of a COPC (USEPA 2004). In the development of 95% UCL values for this project, the recommendations provided by the ProUCL program were used.

In accordance with Region 1 guidance (USEPA Region 1, 1994), the 95% UCLs were compared to the maximum concentration found for each analyte and the smaller of the two was chosen as the EPC and used for the dose calculations. In cases where the data set was small, the maximum concentration was used as the exposure point concentration.

Tables 3-1 through 3-6 present the 95% Upper Confidence Limits (UCLs), the Maximum Concentrations and the EPC selected for each COPC evaluated in each media evaluated.

3.4 Identification of Receptors and Potential Exposure Pathways

An exposure pathway describes the course a chemical or physical agent takes from the source to the exposed individual. A complete exposure pathway generally consists of three elements: (1) a source or chemical release from a source, (2) an exposure point where contact can occur, and (3) (4) an exposure route (i.e., ingestion) at the contact point. If any component is missing, the pathway is deemed incomplete and not quantitatively evaluated in the risk assessment (USEPA, 1989). Elimination of exposure pathways may occur based on professional judgment and evaluation of site-specific conditions, for example if the probability of exposure occurring is low or if the impact of the exposure pathway is expected to minor in comparison to other exposure pathways (USEPA, 1989).

CSM

Figure 4 presents the conceptual site model (CSM) for the project site to assist in the identification of the completed exposure pathways to site-related contamination. The CSM identifies the primary sources of contamination, receiving media, and exposure media, which allows for the identification of potential exposure pathways.

Grove Pond

Based on the information presented earlier, the primary contaminant sources associated with Grove Pond include historical discharge of tannery wastes from a former tannery, and potential effects from a landfill that was formerly located between the tannery and Grove Pond. In addition, north of the tannery were a former foundry and machine shop. East of the former tannery, is Pirone Park, where landfilling may have occurred in the past. Other potential sources of contamination to the pond are: stormwater runoff from the Guilford Transportation railroad yard and causeway on the southern/western shore; historical infilling of portions of the pond's perimeter; inflow from Cold Spring Brook and Balch Pond; and runoff from Fort Devens and the Town of Ayer. Extensive apple orchards lie within the drainage basin for the pond, and historical application of arsenic-containing pesticides has been suggested as a potential contaminant source. The contribution of arsenic and other metals to pond-bottom sediments by discharging groundwater may be significant.

Plow Shop Pond

Plow Shop Pond is bordered to the north by commercial properties. Historical records indicate that a lumber company, northwest of the pond had been in operation since 1887 and at least until 1949. Other potential sources of contamination to the pond are stormwater runoff from the Guilford Transportation railroad and the former Railroad Roundhouse; historical infilling of portions of the pond's perimeter; and Shepley's Hill Landfill.

Identification of Exposure Pathways

The CSM, Figure 4 presents the potential receptors and exposure pathways to be evaluated in this risk assessment. The most likely current and future receptors associated with the two ponds include recreational users and recreational fishermen. Since subsistence fishing may be occurring, a current subsistent fisherman is also evaluated. In addition to fish consumption, the recreational users would be exposed to contaminants in surface water and near-shore sediments while wading or fishing in Grove Pond.

Selection of Exposure Parameters

The exposure parameters selected are intended to determine the Reasonable Maximum Exposure (RME) for each receptor scenario under current site conditions. The RME is the highest exposure that is reasonably expected to occur at a site.

USEPA has established default exposure assumptions for quantifying theoretical exposure doses of site contaminants. When default exposure parameters were not available, parameters were determined based on professional judgment to reflect the specific conditions at the site.

Default exposure assumptions were selected from the following sources:

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.
USEPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.
USEPA, 1994: USEPA, Region 1, Risk Update #2, August 1994.
USEPA, 1995: Supplemental Guidance to RAGS: Region IV Bulletins, Human Health Risk Assessment, EPA Region 4, Atlanta, GA, November 1995
USEPA, 1997: EPA Exposure Factors Handbook, 1997.
USEPA, 2004: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part E, Supplement Guidance for Dermal Risk Assessment, Final Guidance.

All exposure parameters for the RME exposure scenarios are presented in Tables 3.7 through 3.14. Site-specific factors which were determined based on professional judgment are discussed below.

Recreational User and Fisherman

It is assumed that the recreational user and fisherman make three visits per week, during the warmer months of May through September (65 visits per year). The recreational user is assumed to spend approximately 4 hours during each visit to Grove Pond.

The child recreational exposure duration is 6 years, from age 1-6. In order to complete the 30 year exposure duration, the adult exposure was assumed to be 24 years.

There is no default sediment ingestion rate; therefore, the default soil ingestion rate of 100 mg/day was selected as the sediment ingestion rate for the adult receptors. A sediment ingestion rate of 200 mg/day was selected for the child receptors.

The only default values available for ingestion of surface water while wading are presented by USEPA Region 4. Therefore, the surface water ingestion rate of 0.01 l/hour as presented by USEPA Region 4 was selected for the recreational adult receptor. The surface water ingestion rate of 0.05 l/hour as presented by USEPA Region 4 was selected for the recreational child receptor.

Recreational and Subsistence Fisherman
It is assumed that all of fish consumption for both groups of fisherman is from fish caught in Grove Pond or Plow Shop Pond. Therefore, the fraction ingestion is assumed to be 1.

3.5 Estimation of Exposure Doses and Intakes

The next step in the estimation of exposure is to determine the chemical-specific exposures for each pathway identified to be a complete exposure pathway. Exposure estimates are expressed in terms of the mass of the substance in contact with the body per unit body weight per unit time, typically mg of substance/kg of body weight per day. These exposures are termed "intakes" and are equivalent to administered or applied doses. These calculated intakes are expressed as the amount of chemical at the exchange boundary (i.e., skin, lungs, gut) and available for absorption. The administered or applied dose is not equivalent to the amount of substance actually absorbed into the bloodstream. In the case of dermal exposure, intakes are multiplied by an absorption factor to determine the amount of the substance actually absorbed into the blood stream.

Calculation of intake factors or the daily dose for each chemical and receptor was performed for the appropriate exposure pathway (e.g. inhalation, ingestion, dermal). The equations are presented in Tables 3-7 through 3-14.

Dermal exposure requires the determination of absorbed doses rather than applied doses. For sediments or soils, literature-based chemical-specific dermal absorption factors are used in the development of the absorbed dose. The dermal absorption fraction values or ABS_d are presented in Table 3-15.

For exposure to surface water, the development of absorbed doses is more complex. First the amount of chemical absorbed per body area per day must be determined. This value is called the DA_{event} . Table 3-16 presents the derivation of DA_{event} values for each COPC found in Grove Pond or Plow Shop Pond surface water. DA_{event} values are combined with other intake values to obtain the daily absorbed dose (as shown in RAGS D Table 4s).

4.0 TOXICITY ASSESSMENT

The purpose of the toxicity assessment is to weigh available evidence regarding the potential for particular contaminants to cause adverse effects in exposed individuals and to provide, where possible, an estimate of the relationship between the extent of exposure to a contaminant and the increased likelihood of adverse effects (USEPA, 1989). The toxicity assessment is composed of two parts:

- Hazard Identification - Hazard identification is the process of determining whether the exposure to a contaminant can cause an increase in the incidence of a particular adverse health effect. Hazard identification also involves characterizing the nature and strength of the evidence that adverse effects may occur as a result of exposure to an agent.

- Dose Response Evaluation - Does response evaluation is the process of quantitatively evaluating the toxicity information and characterizing the relationship between the dose of the contaminant received and the incidence of adverse health effects in the receptors. From this quantitative dose-response relationship, toxicity values can be derived to estimate the potential for adverse effects in receptors that may have been exposed to different concentrations of the specific agent.

Exposure to carcinogenic and non-carcinogenic toxic contaminants is responsible, by definition, for creating different toxic endpoints or effects. There are also differences in the biological processes through which carcinogenic and non-carcinogenic contaminants can cause adverse effects to a receptor. Therefore, the evaluation of carcinogenic and non-carcinogenic health effects are evaluated separately in human health risk assessments. The methods used to derive toxicity values for carcinogens and non-carcinogens are discussed below.

The toxicity factors (i.e., RfDs and CSFs) used in this risk assessment reflect the most current toxicological information available from the following hierarchy of sources (USEPA, 2003a):

1. Integrated Risk Information System (IRIS) (USEPA, 2004a).
2. Provisional Peer-Reviewed Toxicity Values (PPRTVs) (USEPA, 2004c).
3. Other sources, including but not limited to:
   - National Center for Environmental Assessment (NCEA), presented in Region III's RBC Table (USEPA Region 3, 2005).
   - Office of Environmental Health Hazard Assessment (OEHHA) (Cal/EPA, 2004).
   - Health Effects Assessment Summary Tables (HEAST) (USEPA, 1997b).
   - Values withdrawn from IRIS or HEAST (presented in Region III's RBC Table (USEPA, 2004e).
   - Agency for Toxic Substances and Disease Registry (ATSDR), minimal risk levels (MRLs)(2004).

Noncarcinogenic toxicity values used in the risk assessment are provided in Table 4-1. Information regarding target organ effects is also presented in these tables. Carcinogenic toxicity values and weight of evidence information are presented in Table 4-2.

Quantitative risk assessment cannot be performed for chemicals without chronic toxicity values. COPCs without toxicity values were evaluated qualitatively in the Uncertainty Discussion, Section 5.4 of this risk assessment. In some cases, toxicity information from a chemically and toxicologically similar may be used as a surrogate. Cases in which surrogate toxicity values are clearly indicated in the toxicity tables.

4.1 Noncarcinogenic Dose Response

A number of chemicals have been determined to have toxic effects other than carcinogenesis, such as respiratory illness, skin irritation, etc. In addition, chemicals may also be carcinogenic in addition to other toxic endpoints. The evaluation of noncancer effects (USEPA 1989) involves:

- Qualitative identification of the adverse effect(s) associated with the chemical; these may differ depending on the duration (acute or chronic) or route (oral or inhalation) of exposure
- Identification of the critical effect for each duration of exposure (i.e., the first adverse effect that occurs as dose is increased)
- Estimation of the threshold dose for the critical effect for each duration of exposure
- Development of an uncertainty factor, i.e., quantification of the uncertainty associated with interspecies extrapolation, intraspecies variation in sensitivity, severity of the critical effect, slope of the dose-response curve, and deficiencies in the database, in regard to developing an RfD for human exposure
- Identification of the target organ for the critical effect for each route of exposure

The potential for noncarcinogenic health effects resulting from exposure to chemicals is assessed by comparing an exposure estimate (intake or dose) to a Reference Dose (RfD). RfDs are estimates (with uncertainty spanning perhaps an order of magnitude or greater) of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime. The RfD is expressed in units of mg/kg-day, and represents a daily intake of a contaminant per kilogram of body weight that is not sufficient to cause the threshold effect of concern. An RfD is specific to the chemical, the route of exposure, and the duration over which the exposure occurs. Separate RfDs are represented for ingestion, dermal, and inhalation pathways.

RfDs are expressed as the administered dose. However, exposure estimates for the dermal pathway are expressed as an absorbed dose. Therefore, it is usually necessary to adjust oral toxicity values from administered to absorbed doses in order to evaluate the dermal exposure pathway. Dermal RfDs are derived from the corresponding oral values, provided there is no evidence to suggest that dermal exposure induces exposure route-specific effects that are not appropriately modeled by oral exposure data. Oral toxicity values are adjusted to account for oral absorption efficiencies of the specific chemical. Oral absorption efficiency values are referred to as Gastrointestinal Absorption Factors (ABS_{GI}). Chemical-specific GAF values may be available from toxicological resources, such as ATSDR Toxicological Profiles, and should be used when available.

In the derivation of a dermal RfD, the oral RfD is multiplied by the gastrointestinal absorption factor (ABS_{GI}), expressed as a decimal fraction. The resulting dermal RfD, therefore, is based on absorbed dose. The RfD based on absorbed dose is the appropriate value with which to compare a dermal dose, because dermal doses are expressed as absorbed rather than exposure dose.

RfD values are derived for both chronic and subchronic exposure. Under the assumption of monotoxicity (incidence, intensity, or severity of effects can increase but can not decrease, with increasing magnitude or duration of exposure), a chronic RfD may be considered sufficiently protective for subchronic exposure, but a subchronic RfD may not be protective for chronic exposure. Given the exposure durations involved in the scenarios at the site, chronic RfDs were used for the purposes of this risk assessment. Noncancer toxicity values are provided in Tables 4-1

Target Organ Toxicity

As a matter of science policy, USEPA assumes dose-and effect- additivity for noncarcinogenic effects (USEPA, 1989). This assumption provides the justification for adding the hazard quotients (HQ) or HIs in the risk characterization for noncancer effects resulting from exposure to multiple chemicals, pathways or media. USEPA (1989), however, acknowledges that adding all HQ and HI values may overestimate hazard, because the assumption of additivity is probably appropriate only for those chemicals that exert their toxicity by the same mechanism.

Mechanism of toxicity data sufficient for predicting additivity with a high level of confidence are available for very few chemicals. In the absence of such data, USEPA (1989) assumes that chemicals that act on the same target organ may do so by the same mechanism of toxicity, e.g., target organ serves as a surrogate for mechanism of toxicity. When the total HI for all media for a receptor exceeds 1 due to the contributions of several chemicals, it is appropriate to segregate the chemicals by route of exposure and mechanism of toxicity (i.e., target organ) and estimate separate HI values for each. Segregated target organ Hazard Indices for COPCs are provided in Appendix C, Tables C-29 through C-36 of this report.

As a practical matter, since human environmental exposures are likely to involve near-or sub-threshold doses, the target organ chosen for a given chemical is the one associated with the critical effect. If more than one organ is affected at the threshold, the more severely affected organ is chosen. The target organ is also selected on the basis of duration of exposure (i.e., the target organ for chronic or subchronic exposure to low or moderate doses is selected rather than the target organ for acute exposure to high doses) and route of exposure. Because dermal RfD values are derived from oral RfD values, the oral target organ is adopted as the dermal target organ. For some chemicals, no target organ is identified. This occurs when no adverse effects are observed or when adverse effects such as reduced longevity or growth rate are not accompanied by recognized organ- or system-specific functional or morphologic alteration.

4.2 Carcinogenic Dose-Response

A number of chemicals are known, and many more are suspected, to be human carcinogens. The evaluation of potential carcinogenicity of a chemical includes both a qualitative and a quantitative aspect (USEPA 1989). The qualitative aspect is a weight-of-evidence evaluation of the likelihood that a chemical might induce cancer in humans. The EPA weight-of-evidence classification is a system for characterizing the extent to which the available data indicate that an agent is a human carcinogen (USEPA, 1989). USEPA (1989) currently recognizes six weight-of-evidence classifications for carcinogenicity.

- Group A - Human Carcinogen. Human data are sufficient to identify the chemical as a human carcinogen.

- Group B1 - Probable Human Carcinogen. Human data indicate that a causal association is credible, but alternative explanations can not be dismissed.

- Group B2 - Probable Human Carcinogen. Human data are insufficient to support a causal association, but testing in animals support a causal association.

- Group C - Possible Human Carcinogen. Human data are inadequate or lacking, but animal data suggest a causal association, although the studies have deficiencies that limit interpretation.

- Group D - Not Classifiable as to Human Carcinogenicity. Human and animal data are lacking or inadequate.

- Group E - Evidence of Noncarcinogenicity to Humans. Human data are negative or lacking, and adequate animal data indicate no association with cancer.

USEPA (1989) assumes that a small number of molecular events can create changes in a single cell that can lead to uncontrolled cellular proliferation and eventually to clinical cancer. This hypothesized mechanism for carcinogenesis is referred to “nonthreshold,” because there is believed to be essentially no threshold below which harmful effects may possibly occur as a result of exposure.

The toxicity value for carcinogenicity, called a cancer slope factor (CSF), is an estimate of carcinogen potency. Potency estimates are developed only for chemicals in Groups A, B1, B2, and C (known or suspected carcinogens), and only if data are sufficient. The potency estimates are statistically derived from the dose-response curve from the best human or animal studies of the chemical. The CSFs should always be accompanied by the weight-of-evidence classification to indicate the strength of the evidence that the agent is a human carcinogen (USEPA, 1989). The CSF is usually described as the "excess risk" per unit dose above the rate that might normally be expected in the general population.

The CSF is expressed as risk per mg/kg-day. To be appropriately conservative, the CSF is usually the 95 percent upper-bound on the slope of the dose-response curve extrapolated from high (experimental) doses to the low-dose range expected in environmental exposure scenarios.

The oral CSF is usually derived directly from the experimental dose data, because oral dose is usually expressed as mg/kg-day. When the test chemical is administered in the diet or drinking water, oral dose first must be estimated from the test chemical in the food or water, food or water intake data, and body weight data.

CSFs are expressed as the administered dose. However, exposure estimates for the dermal pathway are expressed as an absorbed dose. Therefore, it is usually necessary to adjust oral toxicity values from administered to absorbed doses in order to evaluate the dermal exposure pathway. Dermal CSFs are derived from the corresponding oral values, provided there is no evidence to suggest that dermal exposure induces exposure route-specific effects that are not appropriately modeled by oral exposure data. Oral toxicity values are adjusted to account for oral absorption efficiencies of the specific chemical. Oral absorption efficiency values are referred to as Gastrointestinal Absorption Factors (ABS_{GI}). Chemical-specific ABS_{GI} values may be available from toxicological resources, such as ATSDR Toxicological Profiles, and should be used when available.

The dermal CSF is derived by dividing the oral CSF by the ABS_{GI}. The oral CSF is divided, rather than multiplied, by the ABS_{GI} because CSFs are expressed as reciprocal dose. The USEPA weight-of-evidence group and the oral, dermal and inhalation CSFs for COPC are presented in Table 4-2.

4.3 Compound-Specific Dose - Response

Carcinogenic PAHs.

The toxicity assessment for carcinogenic PAHs (cPAHs) may be performed with a Toxic Equivalence Factor (TEF) methodology. The toxicity of carcinogenic PAHs is based on a relative potency of each compound to that of benzo(a)pyrene. Cancer slope factors adjusted using TEFs are presented in Table 4-2. As discussed above, all carcinogenic PAHs were retained as COPCs in any medium where at least one carcinogenic PAH exceeded its screening value.

5.0 RISK CHARACTERIZATION

Risk characterization is the combination of the results of the exposure assessment and toxicity assessment to yield a quantitative expression of risk for the exposed receptors. This quantitative expression is the probability of developing cancer, or a nonprobabilistic comparison of estimated dose with a reference dose for noncancer effects. Quantitative estimates are developed for individual chemicals, exposure pathways, and exposure media for each receptor. The risk characterizations presented in this risk assessment are based on the Reasonable Maximum Exposure (RME) scenario and are generally used to guide risk management decisions.

This section presents estimates of risk for the relevant pathways and receptors for each scenario as described in previous sections. All chemicals of concern were evaluated by the determination of non-cancer Hazard Quotients (HQ) and Cancer Risks. Section 5.1 presents the methodology used to calculated noncancer hazards and cancer risks. Section 5.2 discusses cumulative non-cancer health risks and cumulative cancer risks. Section 5.3 discusses the evaluation procedures used in the evaluation of lead.

Generally, risk characterization follows the methodology prescribed by USEPA (1989a), as modified by more recent information and guidance. The USEPA methods are, appropriately, designed to be health-protective, and tend to overestimate, rather than underestimate, risk. The risk results are generally overly conservative, because risk characterization involves multiplication of the conservatism built into the estimation of source-term and exposure-point concentrations, the exposure (intake) estimates, and the toxicity dose-response assessments.

Although some chemicals induce both cancer and noncancer effects, the risks for each endpoint are calculated separately.

5.1 Cancer Risks

For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen.

Cancer Risk Calculation Equation:

$$\mathbf{ILCR_i = CDI_i * CSF_i}$$

Where:

$ILCR_i$ = Incremental Lifetime Cancer Risk for chemical "i," expressed as a unitless probability

CDI_i = Calculated Average Daily Intake of chemical "i" expressed as an average daily dose in (mg/kg-day)

CSF_i = Inhalation cancer slope factor for chemical "i" in $(mg/kg\text{-}day)^{-1}$

Individual chemical-specific cancer risks are summed to estimate the total incremental individual lifetime cancer risk for simultaneous exposure to several carcinogens. The risk summation technique does not presume any synergistic or antagonistic chemical interactions. This assumption may result in either an underestimation or overestimation of the actual risk that may result from actual exposure to multiple substances.

The cancer risk calculations for all receptors are presented in Appendix C in Tables C-1 through C-24. Tables C-1 though C-24 illustrate the development of the intake values and hazard quotients by each medium. Tables C-25 through C-28 present a RAGS D Table 9-style summary of cancer risks for the recreational adult and child receptors for Grove Pond and Plow Shop Pond. These receptors were evaluated for cancer risks from exposure to multiple media including sediments, surface water and fish tissue.

5.2 Non-cancer Risks

The Hazard Quotient (HQ) is the potential for noncarcinogenic effects as a result of exposure. The HQ is a ratio of exposure over a specified period of time to a reference dose derived for a similar period of time. As a rule, the greater the value of the HQ above unity (HQ>1), the greater the level of concern.

Estimating risk or hazard by considering only one chemical at a time might significantly underestimate the risks associated with simultaneous exposures to several COPCs. To assess the potential for noncarcinogenic effects posed by more than one COPC, a Hazard Index (HI) is then calculated. The HI is equal to the sum of the hazard quotients.

The following risk equations were used to calculate hazard quotient (HQ):

Hazard Quotient Calculation Equation:

$$HQ_i = \frac{CDI_i}{RfD_i}$$

Where:

HQ_i = Hazard Quotient for chemical "i" (unitless)

CDI_i = Calculated Average Daily Intake of chemical "i" expressed as an average daily dose in (mg/kg-day)

RfD_i = Reference Dose of chemical "i" in (mg/kg-day)

The hazard index (HI) describes the overall potential for noncarcinogenic effects posed by more than one chemical. The approach assumes that simultaneous exposures to several chemicals could produce an adverse effect. The HI is generated by summing the individual HQs for all the COPCs. The magnitude of the adverse effect is assumed to be proportional to the sum of the ratios of the sub-threshold exposures to acceptable exposures. As with the individual hazard quotients, there is a potential for adverse health effects when the HI exceeds one (1).

Hazard Indices were segregated by target organ and associated critical effect. This approach more appropriately results in identification of endpoints that reflect adverse effects on the same organ system by the same mechanism. Segregation of HI requires identification of the major effect(s) of each COPC. The target organ effect was selected based on the target organ corresponding to the oral RfD listed in IRIS and HEAST or information in ATSDR profiles. In cases where a COPC affects more than one target organ, the HI was used to calculate the target organ effect for each target organ it affects.

The noncancer risk calculations for all receptors are presented in Appendix C. Tables C-1 though C-24 illustrate the development of the intake values and hazard quotients by each medium. Tables C-25 through C-28 present a RAGS D Table 9-style summary of HIs for the recreational adult and child receptors for Grove Pond and Plow Shop Pond. These receptors were evaluated for noncancer hazards from exposure to multiple media including sediments, surface water and fish tissue.

5.3 Lead

Because of its unique toxicological properties, lead requires an alternate evaluation than that performed for non-carcinogenic or carcinogenic chemicals. The output and summary results for the lead evaluation are presented in Appendix D. Output includes RAGS D adult lead worksheets, Adult lead model print outs, RAGS D IEUBK lead model worksheets, IEUBK lead model tabular output and IEUBK probability density function graphs for blood lead.

Adult Recreational Receptor

For the recreational adult receptor, risks from exposure to lead were calculated using the USEPA Adult Lead Model, dated 5/19/03 (USEPA 1996). This approach determines the 95th percentile blood lead concentration among fetuses born to women having exposures to the soil concentration present at the Site. The calculated value is then compared with the threshold blood level for lead of 10 ug/dL which the USEPA has established as being associated with no adverse effects in children. Site-specific EPCs for lead, representing the arithmetic average, for sediment were used in the evaluations of Grove Pond and Plow Shop Pond sediment. Threats from surface water and fish ingestion could not be evaluated for this receptor because currently the model is designed only to consider soils/sediment. The geometric standard deviation for a heterogeneous population was selected as a conservative assumption. Site-specific values for both the exposure frequency of 65 days/year and the averaging time of 152 days a year were used. Model literature on evaluating intermittent exposure to lead indicates that exposures should not be annualized and that models are suitable for use when exposure exceeds three months (see USEPA 2004d). Therefore, exposure for the five month exposure periods of May to September was used as the averaging time. A site-specific sediment ingestion rate of 100 mg/day as shown in the RAGS D Table 4s was used in this modeling as well.

Child Recreational Receptor

An RfD is not available with which to evaluate the toxicity of oral exposure to lead. It is generally agreed that the young child is the most sensitive receptor for exposure to lead. Therefore, evaluating the child recreational receptor exposed to the levels of lead found in the media of interest at the Site provides a worst-case snapshot of the impact of lead. The USEPA (1994b) Integrated Exposure Uptake Biokinetic Model (IEUBK) integrates exposure to lead from various sources to estimate mean blood lead concentrations for the first 7 years of a child's life, and predicts the statistical variation about the mean. The IEUBK model is used to evaluate lead in the various media at the Site. For the recreational child receptor, risks from exposure to lead were calculated using the Integrated Exposure Uptake Biokinetic (IEUBK) Model, version 1.0 build 261.

Exposure input values included arithmetic mean lead concentrations from sediment in Grove Pond and Plow Shop Pond, default drinking water values since arithmetic mean surface water values from both Ponds were less than the default drinking water value and arithmetic mean fish tissue values for fish from Grove Pond. Lead in fish was not a COPC for Plow Shop Pond. Model defaults were used for soil bioavailability and ingestion rate. Because the exposure being evaluated was anticipated to occur regularly over a five or nine month period, no time-adjusted input was needed as discussed in the USEPA guidance in intermittent exposure to lead (see USEPA 2004d). Fish tissue was included by assuming that 41 out of 273 meat meals or 15% of meat meals consisted of Grove Pond Fish. This value was derived from assuming that the recreational child consumed one meal of Grove Pond caught fish per week for nine months of the year (39 weeks).

Child Subsistence Angler Receptor

For the subsistence child angler receptor in Grove Pond, risks from exposure to lead were also calculated using the Integrated Exposure Uptake Biokinetic (IEUBK) Model, version 1.0 build 261. Input parameter values for this receptor were identical to those of the child recreational receptor with one exception. Fish tissue was included by assuming that 273 out of 273 meat meals or 100% of meat meals consisted of Grove Pond Fish. This value was derived from assuming that the recreational child consumed seven meals of Grove Pond caught fish per week for nine months of the year (39 weeks). Because the exposure being evaluated was anticipated to occur regularly over a five or nine month period, no time-adjusted input was needed as discussed the USEPA guidance in intermittent exposure to lead (see USEPA 2004d).

5.4 Qualitative Risk Results

Cumulative Cancer Risks

In order to assess the potential risks the estimated chronic intakes for each pathway are multiplied by the cancer slope factor or the unit risk (used in some inhalation pathways). These results are presented for each pathway in the column entitled Risk in the Tables included in Appendix C. Risks calculated for each chemical are summed to a cumulative risk in each table. RAGS D Table 10s which highlight individual chemical risk drivers are also presented in Appendix C. Cumulative risk summaries by receptor are presented in Table 5-1 for Grove Pond media and Table 5-2 for Plow Shop Pond media.

Grove Pond (see Table 5-1). Cumulative risks from exposure to fish tissue resulted in risks greater than the USEPA specified risk threshold range of 1E-4 to 1E-6 for the adult subsistence angler. Risks equaled 2E-4. The risk drivers (chemicals with risks greater than 1E-6) included PCBs, DDD and DDE. Risks for all other receptors were within the USEPA-specified risk range. However, risks to both the recreational adult and the recreational child equaled the upper end of this range (1E-4). Risk drivers included arsenic and PAHs in sediment, arsenic and bis(2-ethylhexyl)phthalate in surface water and PCBs in fish. Cumulative risks to the child subsistence angler equaled 7E-5.

Plow Shop Pond (see Table 5-2). Cumulative risks from exposure to sediment, surface water and fish resulted in risks greater than the USEPA specified risk threshold range of 1E-4 to 1E-6 for the recreational adult (4E-4) and recreational child receptors (4E-4). The risk drivers included arsenic and PAHs in sediments and arsenic in surface water and fish. Cumulative risks from exposure to fish tissue resulted in risks greater than the USEPA specified risk threshold range of 1E-4 to 1E-6 for the adult subsistence angler. Risks equaled 5E-4. The risk drivers (chemicals with risks greater than 1E-6) included arsenic and DDE. Risks the child subsistence angler equaled the upper end of this range (1E-4). Risk drivers included arsenic and DDE in fish.

Cumulative Non-Cancer Health Risks

In order to assess the potential adverse health effects associated with chronic exposures to site receptors, the estimated chronic intakes for each pathway are compared to the acceptable concentration for each constituent, which is the RfD. These comparisons are ratios of the estimated daily exposure to the RfD and are presented for each pathway in the column entitled Hazard Quotient (HQ) in Appendix C. Hazard Quotients calculated for each chemical are summed to a Hazard Index (HI) in each table.

In the summing of individual HQs, assumptions are made including: the chemicals act in an additive fashion rather than synergistically or antagonistically; the chemicals act on similar organ systems and with similar modes of action. The veracity of these assumptions will impact the accuracy of the hazard estimate developed in this risk characterization.

Grove Pond (see Table 5-1). As shown in Table 5-1, for all receptors evaluated, noncancer hazards exceeded the USEPA-specified risk threshold of one (1). Risk drivers, meaning chemicals with individual HQs in excess of one, for at least one receptor included arsenic in sediment, manganese in surface water and mercury and PCBs in fish.

Plow Shop Pond (see Table 5-2). As shown in Table 5-2, for all receptors evaluated, noncancer hazards exceeded the USEPA-specified risk threshold of one (1). Risk drivers, meaning chemicals with individual HQs in excess of one, for at least one receptor included arsenic and chromium in sediment, arsenic in surface water and mercury and vanadium in fish.

Lead

Results of the lead evaluations are presented in Appendix D and summarized in Tables 5-1 for Grove Ponds and 5-2 for Plow Shop Pond. The blood lead threshold has been established by USEPA as a probability value of no greater than a 5% chance of blood lead exceeding 10 ug/dL for the fetus, as evaluated with the adult lead model, or for the child, as evaluated with the IEUBK model. For Grove Pond, only the child subsistence angler was found to have risks in excess of this threshold. In Plow Shop Pond lead was not a COPC in fish. Neither the adult or child recreational receptors had lead risks that exceeded the associated threshold values.

6.0 UNCERTAINTY ANALYSIS

6.1 Inherent Sources of Uncertainty

Since the assumptions and other aspects of risk assessments are intended to be conservative, some degree of uncertainty is inherent to the process. Inherent sources of uncertainty typically relate to four areas:

1.) the data evaluation process
2.) the exposure assessment;
3.) the toxicity assessment;

4.) the risk characterization.

Inherent sources of uncertainty relating to the data evaluation process include:

- Field Sampling location bias: sample locations were biased toward areas of highest contamination
- Use of one-half the detection limit for all non-detected values when calculating 95% UCLs of the mean
- Lack of consideration of source depletion, natural degradation or attenuation of COPCs over time
- Limitations on the determination of background conditions

Inherent sources of uncertainty relating to the exposure assessment include:

- Assumption that exposure scenarios and contact with affected media will occur
- Selection of the 95% UCL of the mean or the maximum concentration for the exposure point concentration
- Assumption of frequent, routine exposure over prolonged durations
- Use of default exposure values for physiological parameters such as skin surface area, inhalation rate and soil ingestion rates
- Assumption that some pathways are negligible in comparison to others

Inherent sources of uncertainty relating to the toxicity analysis include:

- Use of published RfDs and SFs derived by standard USEPA methods
- Derivation of dermal SFs and RfDs using ABS_{GI} values
- Derivation of toxicity values for cPAHs based on TEFs
- Lack of toxicity values for some chemicals or exposure routes
- Assumption of 100% bioavailability of COPCs from sediment
- Assessment of mercury, which was measured analytically as total mercury, using the oral RfD for mercuric chloride rather than the oral RfD for methylmercury

Inherent sources of uncertainty relating to the risk characterization include:

- Assumption of additivity of toxicological effects
- Risk characterization does not consider antagonistic or synergistic effects. Little information is available to determine the potential for antagonism or synergism for the COPCs. Therefore, this uncertainty cannot be discussed for its impact on the risk assessment, since it may either underestimate or overestimate potential human health risk.

6.2 Site-Specific Sources of Uncertainty

In addition to the uncertainties inherent in the risk assessment process, there are typically uncertainties associated with site-specific information, contaminants or conditions. The following site-specific sources of uncertainty apply to this site:

Data Set Used
These risk results were based upon a data set derived from multiple studies conducted over a 13 year period. Older data may not be indicative of current conditions. However, it is assumed that the direction of bias with this uncertainty would be conservative in that it is not anticipated that conditions in the Ponds would have become more contaminated over time.

Sediment COPC Selection
Since screening values are not available for sediment, residential soil screening values were used in the selection of COPCs for sediment. This is considered a conservative approach which may actually overestimate potential risks.

Surface Water COPC Selection
Since screening values are not available for surface water, tap water screening values were used in the selection of COPCs for surface water. This is considered a conservative approach which may actually overestimate potential risks.

Uncertainties related to Iron and Copper
Risk screening indicated that copper and iron exceeded the EPA Region 9 PRG for residential soil in both ponds. Iron, but not copper, in surface water exceeded the Region 9 PRGs for residential drinking water in both ponds. The toxicity values for iron and copper were derived based on concentrations needed to protect against a deficiency of the compound, rather than on quantitative assessments related to the hazard posed by overexposure to these metals. In fact, USEPA Region I does not advocate quantitatively evaluating exposures and risks of these metals owing to the uncertainty of these toxicity values (USEPA, 1999). Because of the uncertainty of the toxicity information for iron and copper, any risks from exposure to these metals should be considered suspect and greatly overestimated. The uncertainties related to the toxicity values for iron and copper indicate that the potential risks may be greatly overestimated. Therefore, further actions based on concentrations of iron or copper in sediment and surface water seem unwarranted.

Uncertainties related to Background
Many metals occur naturally. Metals in this HHRA were not eliminated as COPCs based on background conditions. As such, risk values reported in this risk assessment include some contribution from background related metals. Since determination of statistically bounded background concentrations is beyond the scope of this investigation, it is not possible to quantify the contribution of background metals to the risk results obtained.

7.0 SUMMARY AND CONCLUSIONS

7.1 Summary of Risk Characterization

Tables 5-1 and 5-2 and Appendix C, Tables C-29 through C-36 present summaries of the cancer risks and noncancer hazard indices which exceeded EPA acceptance criteria for each receptor evaluated in the risk assessment. These tables identify the chemicals which are driving the risks and present the hazard indices segregated by target organ. Section 6.0 presented the uncertainties associated with the risk evaluations and presented rationale for consideration in determining the chemicals of concern for this site which may require further evaluation and action.

7.2 Conclusions

Grove Pond

The human health risk assessment evaluated risks to four receptors: a recreational adult, recreational child, subsistence angler adult and subsistence angler child. Media considered in the recreational receptor evaluations included sediment, surface water and fish tissue. The only medium used in the evaluation of risks to the subsistence angler receptors was fish tissue. For Grove Pond, the carcinogenic risk threshold of 1E-4 was equaled for the recreational adult and recreational child. This threshold was exceeded for the subsistence angler adult. Carcinogenic risk for the subsistence angler child was found to be between 1E-5 and 1E-4. The non-cancer Hazard Index (HI) risk threshold of one (1) was exceeded for all receptors.

Carcinogenic risk drivers, defined as chemicals with risks in excess of 1E-6, for the recreational receptors included arsenic (surface water and sediment), PAHs (sediment), phthalates (surface water) and PCBs (fish tissue). Noncarcinogenic risk drivers, defined as chemicals with hazard quotients (HQs) in excess of one (1), for the recreational receptors included arsenic (sediment), manganese (surface water), mercury (fish tissue), and PCBs (fish tissue).

Carcinogenic risk drivers for the subsistence angler included PCBs, DDD and DDE. Noncarcinogenic risk drivers included mercury and PCBs.

Risk thresholds from potential exposure to lead found in environmental media were not exceeded for recreational adults or children but were exceeded for the subsistence angler child receptor.

Plow Shop Pond

Human health risk assessment results for Plow Shop Pond were similar to those from Grove Pond. For Plow Shop Pond, the carcinogenic risk threshold of 1E-4 was exceeded for the recreational adult and recreational child. This threshold was equaled for the subsistence angler adult. Carcinogenic risk for the subsistence angler child was found to be between 1E-5 and 1E-4. The non-cancer Hazard Index (HI) risk threshold of one (1) was exceeded for all receptors.

Carcinogenic risk drivers for the recreational receptors included arsenic (surface water, sediment and fish tissue), PAHs (sediment) and PCBs (fish tissue). Noncarcinogenic risk drivers, defined as chemicals with hazard quotients (HQs) in excess of one (1), for the recreational receptors included arsenic (sediment, surface water), chromium (sediment), and mercury (fish tissue).

Carcinogenic risk drivers for the subsistence angler included arsenic and DDD. Noncarcinogenic risk drivers included mercury and vanadium.

Risk thresholds from potential exposure to lead found in environmental media were not exceeded for recreational adults or children. Lead was not a chemical of potential concern in fish tissue from Plow Shop Pond.

Evaluation of Results

This section compares human health risk results to the findings of the fate and transport/environmental chemistry evaluation performed for this study. Of this risk drivers identified in the human health risk assessment, the metals arsenic, chromium, mercury and lead appear to be related to identifiable sources within Grove and Plow Shop Ponds including area-wide groundwater for arsenic. Vanadium and manganese have not been identified as metals with clear Pond-related sources. It is possible that elevated levels of these metals and associated risks occur as a result of mobilization of naturally occurring metals by reduced groundwater that enters the ponds from the direction of Shepley's Hill Landfill or other areas.

Organic constituents identified as risk drivers include PAHs, PCBs and DDT breakdown products. While these chemicals are clearly anthropogenically-related, multiple sources for these chemicals appear applicable. Sources may have included upstream contamination, stormwater runoff, atmospheric deposition as well as contributions from the former tannery and railroad roundhouse located on the shores of these ponds. Currently, it is not possible to clearly attribute the contribution levels of these sources to the concentrations observed. However, it does not appear that groundwater is a contributor of organic constituents to the Ponds.

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FIGURES

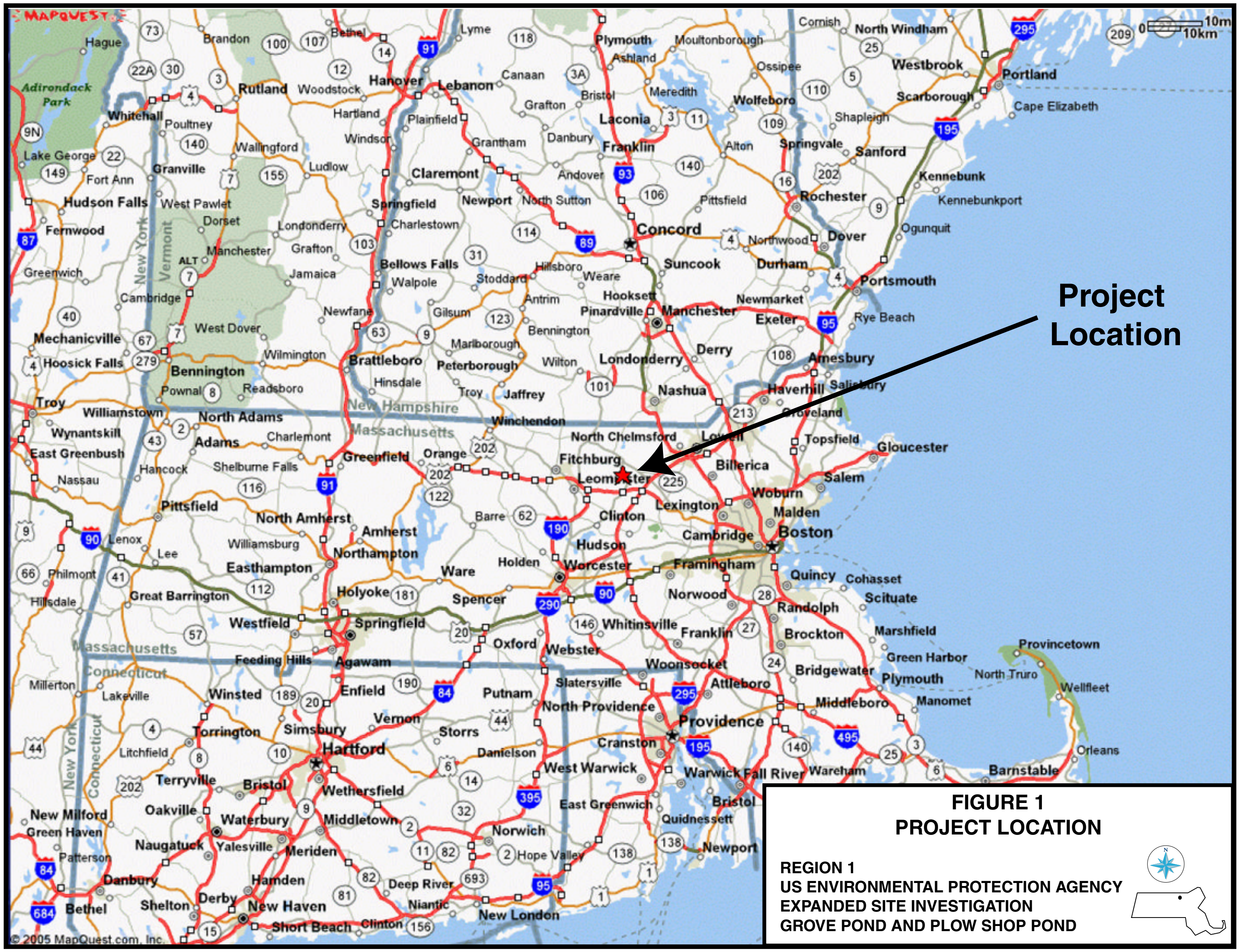


FIGURE 1
PROJECT LOCATION

REGION 1
US ENVIRONMENTAL PROTECTION AGENCY
EXPANDED SITE INVESTIGATION
GROVE POND AND PLOW SHOP POND

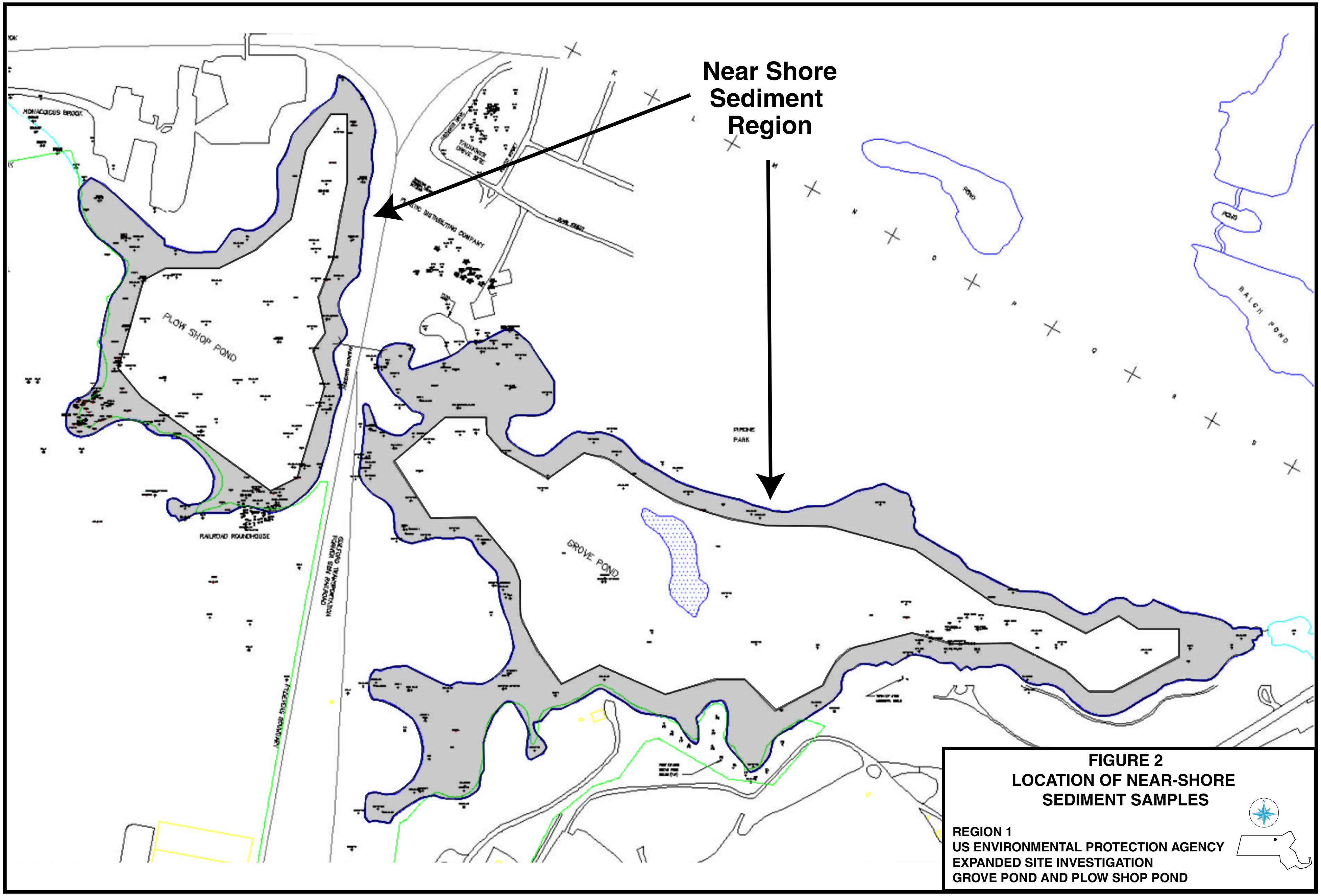


FIGURE 2
LOCATION OF NEAR-SHORE SEDIMENT SAMPLES

REGION 1
US ENVIRONMENTAL PROTECTION AGENCY
EXPANDED SITE INVESTIGATION
GROVE POND AND PLOW SHOP POND

FIGURE 3
COMPARISON OF FILLET TO WHOLE FISH TISSUE RESULTS
GROVE POND/PLOW SHOP POND

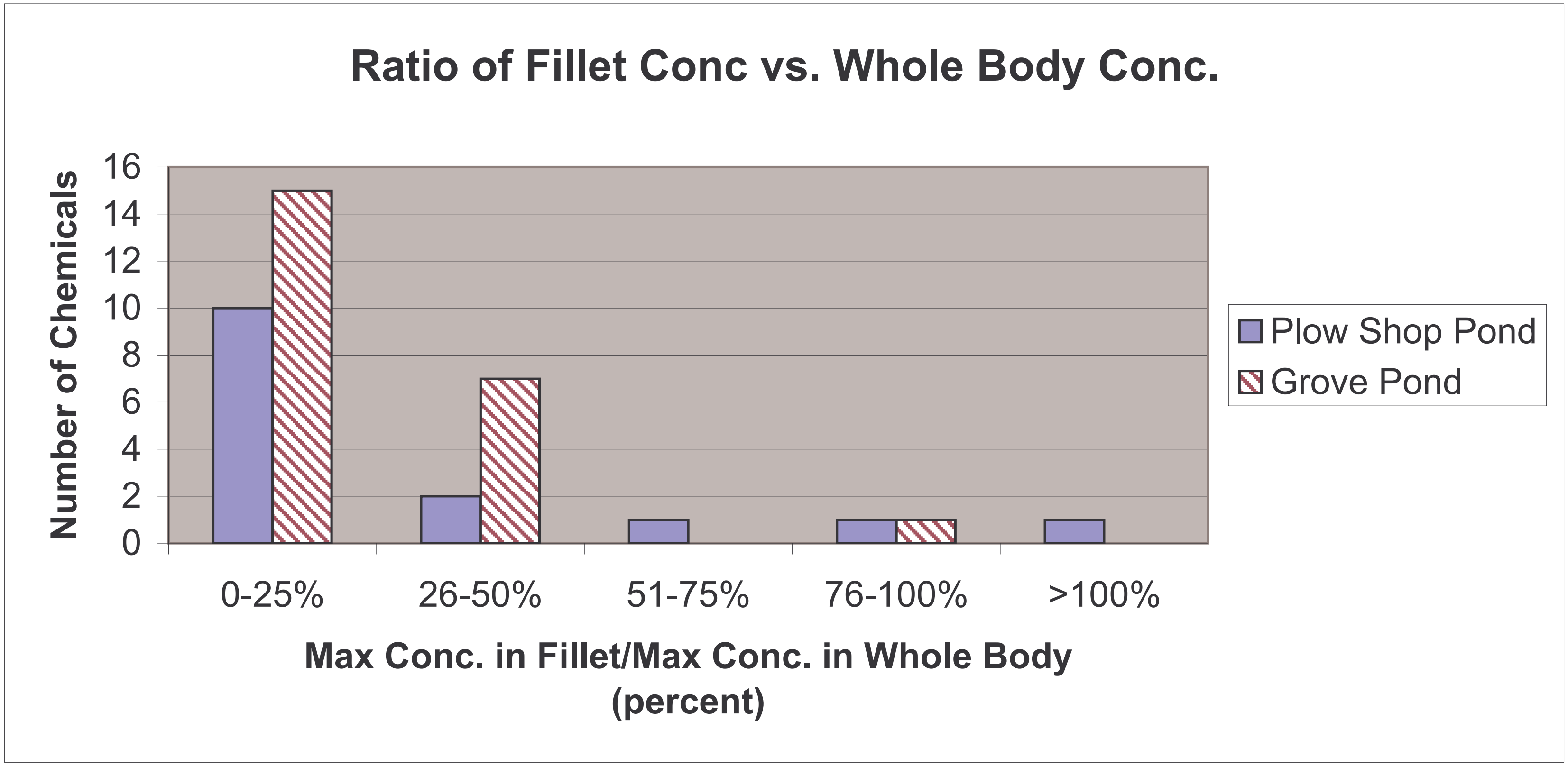


FIGURE 4
SELECTION OF EXPOSURE PATHWAYS
RAGS D TABLE 1
GROVE POND and PLOW SHOP POND

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	**Surface Water**	Surface Water	Grove Pond	Recreational User	Adult	Ingestion	**Quant**	Onsite receptor may be exposed to surface water during recreational activities.
						Dermal	**Quant**	Onsite receptor may be exposed to surface water during recreational activities.
					Child	Ingestion	**Quant**	Onsite receptor may be exposed to surface water during recreational activities.
						Dermal	**Quant**	Onsite receptor may be exposed to surface water during recreational activities.
		Air	Volatilization of VOCs	Recreational User	Adult	Inhalation	None	This pathway presents a negligible risk to receptor. VOCs are not prevalent in pond surface water.
					Child	Inhalation	None	This pathway presents a negligible risk to receptor. VOCs are not prevalent in pond surface water.
	Near-shore Sediment	Sediment	Grove Pond	Recreational User	Adult	Ingestion	**Quant**	Onsite receptor may be exposed to sediment during wading-related recreational activities.
						Dermal	**Quant**	Onsite receptor may be exposed to sediment during wading-related recreational activities.
					Child	Ingestion	**Quant**	Onsite receptor may be exposed to sediment during wading-related recreational activities.
						Dermal	**Quant**	Onsite receptor may be exposed to sediment during wading-related recreational activities.
	Fish	Fish	Grove Pond	Recreational User	Adult	Ingestion	**Quant**	Onsite receptor may be exposed to contaminants during fish consumption.
					Child	Ingestion	**Quant**	Onsite receptor may be exposed to contaminants during fish consumption.
Future	**Fish**	Fish	Grove Pond	Subsistence Fisherman	Adult	Ingestion	**Quant**	Currently there is no evidence that subsistence fishing occurs in this Pond. However, subsistence fishing, though unlikely, may occur at some point in the future.
					Child	Ingestion	**Quant**	Currently there is no evidence that subsistence fishing occurs in this Pond. However, subsistence fishing, though unlikely, may occur at some point in the future.

FIGURE 4
SELECTION OF EXPOSURE PATHWAYS
RAGS D TABLE 1
GROVE POND and PLOW SHOP POND

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	**Surface Water**	Surface Water	Plow Shop Pond	Recreational User	Adult	Ingestion	**Quant**	Onsite receptor may be exposed to surface water during recreational activities.
						Dermal	**Quant**	Onsite receptor may be exposed to surface water during recreational activities.
					Child	Ingestion	**Quant**	Onsite receptor may be exposed to surface water during recreational activities.
						Dermal	**Quant**	Onsite receptor may be exposed to surface water during recreational activities.
		Air	Volatilization of VOCs	Recreational User	Adult	Inhalation	None	This pathway presents a negligible risk to receptor. VOCs are not prevalent in pond surface water.
					Child	Inhalation	None	This pathway presents a negligible risk to receptor. VOCs are not prevalent in pond surface water.
	Near-shore Sediment	Sediment	Plow Shop Pond	Recreational User	Adult	Ingestion	**Quant**	Onsite receptor may be exposed to sediment during wading-related recreational activities.
						Dermal	**Quant**	Onsite receptor may be exposed to sediment during wading-related recreational activities.
					Child	Ingestion	**Quant**	Onsite receptor may be exposed to sediment during wading-related recreational activities.
						Dermal	**Quant**	Onsite receptor may be exposed to sediment during wading-related recreational activities.
	Fish	Fish	Plow Shop Pond	Recreational User	Adult	Ingestion	**Quant**	Onsite receptor may be exposed to contaminants during fish consumption.
					Child	Ingestion	**Quant**	Onsite receptor may be exposed to contaminants during fish consumption.
Future	**Fish**	Fish	Plow Shop Pond	Subsistence Fisherman	Adult	Ingestion	**Quant**	Currently there is no evidence that subsistence fishing occurs in this Pond. However, subsistence fishing, though unlikely, may occur at some point in the future.
					Child	Ingestion	**Quant**	Currently there is no evidence that subsistence fishing occurs in this Pond. However, subsistence fishing, though unlikely, may occur at some point in the future.

TABLES

TABLE 2-1
COMPARISION OF NEAR-SHORE SEDIMENT RESULTS WITH ALL SEDIMENT RESULTS
GROVE POND/PLOW SHOP POND
UNITS mg/kg

AOC	Detected Chemical	Max Detect		Min Detect		Avg Detect		Near shore Avg detect higher?	Percent	Near shore 2x higher?	Near shore 1.5x higher?	Near shore 1.25x higher?	Frequency of Detection	
		All	Near-shore	All	Near-shore	All	Near-shore						All	Near-shore
Grove Pond	Aluminum	90000	90000	0.54	1.1	1.04E+04	1.09E+04	yes	104.1	no	no	no	145 / 145	119 / 119
	Antimony	49.2	49.2	5	5	2.13E+01	2.04E+01	no	96.0	no	no	no	19 / 132	14 / 106
	Arsenic	1300	1300	2.86	2.86	8.63E+01	8.68E+01	yes	100.6	no	no	no	150 / 160	121 / 131
	Barium	470	470	7.4	7.4	8.68E+01	8.41E+01	no	96.9	no	no	no	124 / 143	101 / 117
	Beryllium	14.1	14.1	0.5	0.5	2.59E+00	2.85E+00	yes	109.8	no	no	no	37 / 137	31 / 111
	Cadmium	730	730	0.489	0.489	2.78E+01	2.51E+01	no	90.4	no	no	no	87 / 153	64 / 124
	Calcium	340000	170000	0.51	0.51	1.57E+04	1.21E+04	no	77.6	no	no	no	130 / 130	104 / 104
	Chromium, total	52000	52000	4.69	4.69	5.28E+03	5.44E+03	yes	103.1	no	no	no	154 / 159	125 / 130
	Cobalt	70	70	2.29	2.29	1.94E+01	1.77E+01	no	91.3	no	no	no	92 / 140	73 / 114
	Copper	13000	13000	2.61	2.61	1.42E+02	1.63E+02	yes	114.3	no	no	no	143 / 147	117 / 121
	Iron	42800	42800	0.87	2	1.39E+04	1.35E+04	no	97.1	no	no	no	145 / 145	119 / 119
	Lead	1760	1760	3.21	3.29	2.44E+02	2.47E+02	yes	101.4	no	no	no	151 / 159	122 / 130
	Magnesium	5300	5300	184	184	1.82E+03	1.75E+03	no	96.1	no	no	no	120 / 130	95 / 104
	Manganese	2500	2500	0.39	0.39	5.36E+02	4.77E+02	no	88.9	no	no	no	148 / 148	122 / 122
	Mercury	422	422	0.02452	0.02452	2.91E+01	3.31E+01	yes	114.0	no	no	no	108 / 134	84 / 108
	Nickel	88	69.9	1.98	1.98	2.99E+01	2.76E+01	no	92.3	no	no	no	129 / 145	105 / 119
	Potassium	4120	4120	100	100	1.03E+03	9.18E+02	no	89.0	no	no	no	60 / 130	48 / 104
	Selenium	41.2	41.2	0.424	0.424	9.20E+00	7.69E+00	no	83.6	no	no	no	47 / 140	39 / 114
	Silver	12.4	12.4	0.792	0.702	5.89E+00	5.40E+00	no	91.7	no	no	no	16 / 74	13 / 63
	Sodium	7020	6370	100	100	2.07E+03	1.90E+03	no	91.5	no	no	no	102 / 130	79 / 104
	Thallium	82.4	82.4	0.1	0.1	2.75E+01	2.21E+01	no	80.3	no	no	no	25 / 121	20 / 96
	Vanadium	140	140	5.1	5.1	3.56E+01	3.28E+01	no	92.3	no	no	no	112 / 141	92 / 115
	Zinc	820	770	3.12	3.12	2.58E+02	2.26E+02	no	87.5	no	no	no	140 / 149	110 / 123
	Mercury, methyl	0.07044	0.07044	0.00028	0.00028	2.44E-02	2.73E-02	yes	111.7	no	no	no	14 / 14	9 / 9
	Acenaphthene	1.3	1.3	0.019	0.019	3.07E-01	3.76E-01	yes	122.2	no	no	no	5 / 42	4 / 40
	Acenaphthylene	0.22	0.22	0.046	0.049	1.12E-01	1.29E-01	yes	114.8	no	no	no	5 / 99	4 / 83
	Anthracene	2.4	2.4	0.081	0.081	6.29E-01	6.81E-01	yes	108.3	no	no	no	11 / 99	10 / 83
	Benz(a)anthracene	3.4	3.4	0.19	0.19	1.38E+00	1.51E+00	yes	109.4	no	no	no	10 / 99	9 / 83
	Benzo(a)pyrene	2.3	2.3	0.19	0.37	9.31E-01	1.04E+00	yes	111.4	no	no	no	8 / 42	7 / 40
	Benzo(b)fluoranthene	5	5	0.075	0.075	1.63E+00	1.84E+00	yes	113.0	no	no	no	7 / 91	6 / 75
	Benzo(ghi)perylene	1.4	1.4	0.028	0.084	8.07E-01	1.00E+00	yes	124.1	no	no	no	5 / 42	4 / 40
	Benzo(k)fluoranthene	4.9	4.9	0.11	0.21	1.30E+00	1.40E+00	yes	107.6	no	no	no	13 / 99	12 / 83
	Chrysene	5	5	0.051	0.051	1.59E+00	1.68E+00	yes	105.6	no	no	no	15 / 99	14 / 83
	Dibenz(ah)anthracene	0.73	0.73	0.03	0.03	2.44E-01	3.40E-01	yes	139.3	no	no	yes	3 / 27	2 / 25
	Fluoranthene	7.1	7.1	0.06	0.06	2.12E+00	2.23E+00	yes	105.4	no	no	no	23 / 99	21 / 83
	Fluorene	1.1	1.1	0.049	0.049	4.41E-01	5.13E-01	yes	116.2	no	no	no	6 / 99	5 / 83
	Indeno(1,2,3-cd)pyrene	2.9	2.9	0.037	0.037	1.34E+00	1.34E+00	no	100.0	no	no	no	4 / 42	4 / 40
	Methylnaphthalene, 1-	1.1	1.1	1.1	1.1	1.10E+00	1.10E+00	no	100.0	no	no	no	1 / 15	1 / 15
	Methylnaphthalene, 2-	4	4	0.47	0.47	1.45E+00	1.45E+00	no	100.0	no	no	no	9 / 96	9 / 81
	Naphthalene	30	30	0.034	0.034	3.39E+00	3.60E+00	yes	106.4	no	no	no	27 / 99	23 / 83
	Phenanthrene	7.7	7.7	0.043	0.043	1.47E+00	1.51E+00	yes	102.6	no	no	no	24 / 99	23 / 83
	Pyrene	6.5	6.5	0.059	0.059	1.85E+00	1.94E+00	yes	104.8	no	no	no	30 / 99	28 / 83
	DDD, p,p'-	2.5	2.5	0.0087	0.0087	2.96E-01	3.04E-01	yes	102.9	no	no	no	44 / 100	40 / 84
	DDE, p,p'-	0.98	0.98	0.01	0.01	1.98E-01	2.04E-01	yes	103.4	no	no	no	47 / 100	39 / 84
	DDT, p,p'-	3.3	1.5	0.01	0.01	3.50E-01	2.69E-01	no	76.8	no	no	no	17 / 100	16 / 84
	Endrin	0.028	0.028	0.028	0.028	2.80E-02	2.80E-02	no	100.0	no	no	no	1 / 85	1 / 69
	Benzyl alcohol	19	19	1.7	1.7	1.04E+01	1.04E+01	no	100.0	no	no	no	2 / 24	2 / 23
	Bis(2-ethylhexyl) phthalate	4.9	4.9	0.41	0.41	2.66E+00	2.66E+00	no	100.0	no	no	no	2 / 16	2 / 15
	Bromophenyl phenyl ether, 4-	1.7	1.7	1.7	1.7	1.70E+00	1.70E+00	no	100.0	no	no	no	1 / 73	1 / 58
	Butylbenzyl phthalate	3	3	3	3	3.00E+00	3.00E+00	no	100.0	no	no	no	1 / 66	1 / 51
	Chlorophenyl phenyl ether, 4-	0.84	0.84	0.84	0.84	8.40E-01	8.40E-01	no	100.0	no	no	no	1 / 73	1 / 58
	Dibenzofuran	0.7	0.7	0.083	0.083	3.48E-01	3.48E-01	no	100.0	no	no	no	6 / 81	6 / 66
	Di-n-butyl phthalate	8	8	3.3	3.3	5.65E+00	5.65E+00	no	100.0	no	no	no	2 / 88	2 / 73
	Hexachlorobenzene	1.7	1.7	1.7	1.7	1.70E+00	1.70E+00	no	100.0	no	no	no	1 / 73	1 / 58
	Toluene	0.0042	0.0042	0.0042	0.0042	4.20E-03	4.20E-03	no	100.0	no	no	no	1 / 22	1 / 21
	Xylenes, total	0.0164	0.0164	0.0164	0.0164	1.64E-02	1.64E-02	no	100.0	no	no	no	1 / 22	1 / 21

TABLE 2-1
COMPARISION OF NEAR-SHORE SEDIMENT RESULTS WITH ALL SEDIMENT RESULTS
GROVE POND/PLOW SHOP POND
UNITS mg/kg

AOC	Detected Chemical	Max Detect		Min Detect		Avg Detect		Near shore Avg detect higher?	Percent	Near shore 2x higher?	Near shore 1.5x higher?	Near shore 1.25x higher?	Frequency of Detection	
		All	Near-shore	All	Near-shore	All	Near-shore						All	Near-shore
Plow Shop Pond	Aluminum	27000	27000	1	1	6.70E+03	6.75E+03	yes	100.7	no	no	no	189 / 189	138 / 138
	Antimony	30.7	30.7	5	5	1.17E+01	1.37E+01	yes	116.6	no	no	no	10 / 90	7 / 71
	Arsenic	6800	6800	0.11	0.11	3.90E+02	4.50E+02	yes	115.3	no	no	no	198 / 209	143 / 151
	Barium	370	370	0.16	0.27	8.22E+01	8.80E+01	yes	107.0	no	no	no	175 / 198	127 / 140
	Beryllium	5.41	5.41	0.4	0.4	1.54E+00	1.59E+00	yes	103.2	no	no	no	33 / 167	27 / 127
	Cadmium	66	66	0.792	0.792	1.63E+01	1.68E+01	yes	103.1	no	no	no	69 / 190	54 / 132
	Calcium	34000	34000	0.39	0.39	8.20E+03	8.09E+03	no	98.6	no	no	no	187 / 189	136 / 138
	Chromium, total	37800	37800	6.9	6.9	1.72E+03	1.46E+03	no	84.6	no	no	no	184 / 209	138 / 151
	Cobalt	59	59	1.5	1.98	1.48E+01	1.47E+01	no	99.4	no	no	no	82 / 170	67 / 126
	Copper	3450	3450	2.6	2.91	1.01E+02	1.20E+02	yes	118.5	no	no	no	149 / 192	110 / 141
	Iron	410000	410000	2.5	2.5	3.79E+04	4.65E+04	yes	122.8	no	no	no	189 / 189	138 / 138
	Lead	1214.31	1214.31	0.757	0.956	1.28E+02	1.37E+02	yes	107.8	no	no	no	180 / 209	128 / 151
	Magnesium	8580	8580	13.6	13.6	1.56E+03	1.56E+03	yes	100.4	no	no	no	174 / 189	129 / 138
	Manganese	54800	54800	16.9	31	1.64E+03	2.00E+03	yes	122.3	no	no	no	188 / 192	137 / 141
	Mercury	750	130	0.038	0.038	2.28E+01	1.62E+01	no	70.9	no	no	no	103 / 204	124 / 148
	Nickel	87.8	87.8	4	6.3	2.81E+01	2.74E+01	no	97.6	no	no	no	125 / 192	93 / 141
	Potassium	2340	2340	90.5	90.5	7.76E+02	7.56E+02	no	97.4	no	no	no	68 / 188	55 / 137
	Selenium	19.2	19.2	0.496	0.496	3.88E+00	4.04E+00	yes	104.3	no	no	no	54 / 163	33 / 128
	Silver	2	2	0.589	0.589	1.57E+00	1.45E+00	no	92.2	no	no	no	9 / 90	7 / 77
	Sodium	4280	4280	123	123	1.32E+03	1.10E+03	no	83.0	no	no	no	136 / 188	87 / 137
	Thallium	29.4	29.4	19.4	19.7	2.19E+01	2.33E+01	yes	106.6	no	no	no	5 / 64	3 / 56
	Tin	275	275	8.13	8.13	1.33E+02	1.33E+02	no	100.0	no	no	no	3 / 4	3 / 4
	Vanadium	160	166	3.2	3.2	3.39E+01	3.17E+01	no	93.7	no	no	no	91 / 169	78 / 138
	Zinc	1100	1100	9	9	2.01E+02	1.79E+02	no	89.4	no	no	no	122 / 192	95 / 141
	Mercury, methyl	0.68169	0.06538	0.00113	0.0057	3.67E-02	3.54E-02	no	96.7	no	no	no	10 / 10	8 / 8
	Acenaphthene	0.84	0.84	0.0063	0.0063	1.44E-01	1.84E-01	yes	127.5	no	no	yes	11 / 15	7 / 11
	Acenaphthylene	0.71	0.71	0.026	0.026	2.06E-01	1.88E-01	no	91.6	no	no	no	11 / 11	7 / 7
	Anthracene	3.4	3.4	0.036	0.036	5.62E-01	6.40E-01	yes	113.9	no	no	no	12 / 15	8 / 11
	Benz(a)anthracene	7.1	7.1	0.09	0.09	1.22E+00	1.34E+00	yes	109.1	no	no	no	13 / 28	9 / 23
	Benzo(a)pyrene	6.5	6.5	0.12	0.12	1.25E+00	1.37E+00	yes	109.4	no	no	no	11 / 11	7 / 7
	Benzo(b)fluoranthene	11	11	0.12	0.12	2.24E+00	2.23E+00	no	99.8	no	no	no	12 / 15	8 / 11
	Benzo(ghi)perylene	5.2	5.2	0.072	0.072	1.21E+00	1.20E+00	no	99.9	no	no	no	11 / 11	7 / 7
	Benzo(k)fluoranthene	3.7	3.7	0.071	0.071	7.97E-01	8.56E-01	yes	107.5	no	no	no	12 / 15	8 / 11
	Chrysene	8.1	8.1	0.032	0.032	1.66E+00	1.70E+00	yes	102.7	no	no	no	13 / 28	9 / 23
	Dibenz(ah)anthracene	1.3	1.3	0.028	0.028	3.09E-01	3.26E-01	yes	105.5	no	no	no	11 / 11	7 / 7
	Fluoranthene	18	18	0.013	0.013	3.09E+00	3.26E+00	yes	105.4	no	no	no	14 / 28	10 / 23
	Fluorene	1.9	1.9	0.025	0.025	3.39E-01	3.64E-01	yes	107.4	no	no	no	12 / 15	8 / 11
	Indeno(1,2,3-cd)pyrene	4.5	4.5	0.048	0.048	1.04E+00	1.04E+00	yes	100.8	no	no	no	11 / 11	7 / 7
	Methylnaphthalene, 2-	2	2	1	1	1.67E+00	1.67E+00	no	100.0	no	no	no	3 / 4	3 / 4
	Naphthalene	2.4	2.4	0.024	0.024	7.62E-01	8.87E-01	yes	116.4	no	no	no	15 / 29	11 / 24
	Phenanthrene	10	10	0.13	0.13	1.70E+00	1.88E+00	yes	110.1	no	no	no	15 / 28	11 / 23
	Pyrene	14	14	0.24	0.24	2.55E+00	2.69E+00	yes	105.4	no	no	no	17 / 28	13 / 23
	PCB 1242	0.11	0.11	0.11	0.11	1.10E-01	1.10E-01	no	100.0	no	no	no	1 / 11	1 / 7
	PCB 1254	0.13	0.13	0.13	0.13	1.30E-01	1.30E-01	no	100.0	no	no	no	1 / 11	1 / 7
	PCB 1260	0.05	0.05	0.05	0.05	5.00E-02	5.00E-02	no	100.0	no	no	no	1 / 11	1 / 7
	DDD, p,p'-	1.8	1.8	0.013	0.013	2.03E-01	2.51E-01	yes	123.6	no	no	no	16 / 82	12 / 47
	DDE, p,p'-	1.3	1.3	0.028	0.028	1.52E-01	1.75E-01	yes	114.9	no	no	no	21 / 103	16 / 67
	DDT, p,p'-	0.13	0.13	0.0033	0.0033	2.86E-02	3.42E-02	yes	119.4	no	no	no	10 / 90	8 / 55
	Heptachlor	0.092	0.092	0.02	0.02	5.60E-02	5.60E-02	no	100.0	no	no	no	2 / 24	2 / 19
	Dibenzofuran	0.8	0.8	0.4	0.4	6.00E-01	6.00E-01	no	100.0	no	no	no	2 / 4	2 / 4
	Acetone	2.6	0.54	0.059	0.058	5.23E-01	2.64E-01	no	50.4	no	no	no	9 / 14	8 / 13
	Methyl ethyl ketone	0.13	0.13	0.023	0.023	9.02E-02	9.02E-02	no	100.0	no	no	no	5 / 14	5 / 13
	Methylene chloride	0.12	0.12	0.021	0.021	6.02E-02	5.64E-02	no	93.7	no	no	no	11 / 14	10 / 13
	Trichlorofluoromethane	0.008	0.008	0.008	0.008	8.00E-03	8.00E-03	no	100.0	no	no	no	2 / 16	2 / 16

TABLE 2-2
COMPARISON OF FILLET TO WHOLE FISH TISSUE
GROVE POND

Chemical	Fillet Frequency of Detection	Fillet % Detected	Whole Body Frequency of Detection	Whole Body % Detected	Fillet Concentration Range (mg/kg-ww) Min		Fillet Concentration Range (mg/kg-ww) Max	Whole Body Concentration Range (mg/kg-ww) Min		Whole Body Concentration Range (mg/kg-ww) Max	Ratio of Fillet Maximum Concentration to Whole Body Maximum Concentration (percent)
Aluminum	18 / 18	100%	30 / 32	94%	1.45	-	4.15	1.48	-	20.70	**20%**
Antimony			0 / 4	0%				(ND0.76	-	ND1.1)	
Arsenic	0 / 18	0%	2 / 32	6%	(ND0.078	-	ND 0.117)	0.13	-	0.13	
Barium	5 / 18	28%	32 / 32	100%	0.10	-	0.15	0.17	-	3.68	**4%**
Beryllium	4 / 18	22%	8 / 32	25%	0.03	-	0.14	0.07	-	0.99	**14%**
Boron	4 / 18	22%	15 / 28	54%	0.16	-	0.34	0.13	-	1.39	**25%**
Cadmium	5 / 18	28%	23 / 32	72%	0.03	-	0.15	0.03	-	1.02	**15%**
Calcium			0 / 4	0%				(ND1.5	-	ND2.3)	
Chromium, total	18 / 18	100%	32 / 32	100%	0.10	-	0.49	0.32	-	1.80	**27%**
Cobalt			0 / 4	0%				(ND0.23	-	ND0.34)	
Copper	18 / 18	100%	32 / 32	100%	0.11	-	0.60	0.30	-	1.35	**44%**
Iron	18 / 18	100%	32 / 32	100%	2.82	-	13.88	7.57	-	76.56	**18%**
Lead	8 / 18	44%	27 / 32	84%	0.10	-	0.86	0.16	-	5.02	**17%**
Magnesium	18 / 18	100%	32 / 32	100%	213.53	-	372.40	329.60	-	744.80	**50%**
Manganese	18 / 18	100%	32 / 32	100%	0.07	-	1.41	2.20	-	54.00	**3%**
Mercury	16 / 18	89%	29 / 32	91%	0.05	-	1.04	0.03	-	1.14	**91%**
Molybdenum	1 / 18	6%	6 / 28	21%	0.15	-	0.15	0.14	-	0.51	**30%**
Nickel	7 / 18	39%	15 / 32	47%	0.09	-	0.91	0.11	-	4.85	**19%**
Potassium			4 / 4	100%				3100.00	-	3400.00	**0%**
Selenium	13 / 18	72%	28 / 32	88%	0.10	-	0.18	0.14	-	0.55	**32%**
Silver			0 / 4	0%				(ND0.23	-	ND0.34)	
Sodium			4 / 4	100%				920.00	-	1500.00	**0%**
Strontium	18 / 18	100%	28 / 28	100%	0.15	-	4.24	11.68	-	48.48	**9%**
Thallium			0 / 4	0%				(ND1.5	-	ND2.3)	
Vanadium	2 / 18	11%	7 / 32	22%	0.12	-	0.16	0.12	-	0.92	**18%**
Zinc	18 / 18	100%	32 / 32	100%	3.63	-	7.95	10.54	-	42.00	**19%**
PCBs, total	5 / 18	28%	14 / 28	50%	0.07	-	0.15	0.09	-	0.47	**32%**
DDD, p,p'-	9 / 18	50%	31 / 32	97%	0.01	-	0.03	0.01	-	0.13	**23%**
DDE, p,p'-	15 / 18	83%	32 / 32	100%	0.01	-	0.07	0.01	-	0.27	**26%**

	Fillet	Whole Body
Average Percent Detected	**60%**	**64%**

Number of Chemicals

Percentile:	**0-25%**	**15**	**Avg**	**23%**
	26-50%	**7**	**Min**	**0%**
	51-75%	**0**	**Max**	**91%**
	76-100%	**1**	**Median**	**19%**
	>100%	**0**		

TABLE 2-3
COMPARISON OF FILLET TO WHOLE FISH TISSUE
PLOW SHOP POND

Chemical	Fillet Frequency of Detection	Fillet % Detected	Whole Body Frequency of Detection	Whole Body % Detected	Fillet Concentration Range (mg/kg ww) Min		Fillet Concentration Range (mg/kg ww) Max	Whole Body Concentration Range (mg/kg-ww) Min		Whole Body Concentration Range (mg/kg-ww) Max	Ratio of Fillet Maximum Concentration to Whole Body Maximum Concentration (percent)
Aluminum	0 / 10	0%	14 / 19	74%	ND(1.3	-	1.3)	1.6	-	4.5	
Antimony	0 / 10	0%	0 / 19	0%	ND(1.1	-	1.1)	ND(0.73	-	1.1)	
Arsenic	2 / 10	20%	2 / 19	11%	0.09	-	0.15	0.3	-	103	**0%**
Barium	0 / 10	0%	19 / 19	100%	ND(0.23	-	0.24)	0.27	-	4.4	
Beryllium	0 / 10	0%	0 / 19	0%	ND(0.04	-	0.04)	ND(0.04	-	0.089)	
Cadmium	0 / 10	0%	1 / 19	5%	ND(0.05	-	0.07)	0.09	-	0.09	
Calcium	10 / 10	100%	15 / 19	79%	82.8	-	627	3250	-	48800	**1%**
Chromium, total	2 / 10	20%	18 / 19	95%	0.19	-	0.24	0.25	-	0.99	**24%**
Cobalt	2 / 10	20%	5 / 19	26%	0.11	-	0.11	0.1	-	0.17	**65%**
Copper	10 / 10	100%	19 / 19	100%	0.08	-	0.24	0.29	-	1.3	**18%**
Iron	10 / 10	100%	19 / 19	100%	1.7	-	27	11	-	130	**21%**
Lead	0 / 10	0%	2 / 18	11%	ND(0.1	-	0.1)	0.16	-	0.18	
Magnesium	10 / 10	100%	19 / 19	100%	252	-	344	249	-	754	**46%**
Manganese	1 / 10	10%	19 / 19	100%	0.3	-	0.3	5.1	-	94.7	**0%**
Mercury	9 / 10	90%	18 / 19	95%	0.12	-	4	0.09	-	2.7	**148%**
Nickel	0 / 10	0%	1 / 19	5%	ND(0.75	-	0.8)	0.8	-	0.8	
Potassium			4 / 4					3100	-	3400	**0%**
Selenium	8 / 10	80%	14 / 19	74%	0.11	-	0.2	0.24	-	0.67	**30%**
Silver	0 / 10	0%	0 / 19	0%	ND(0.19	-	0.2)	ND(0.19	-	0.27)	
Sodium	10 / 10	100%	19 / 19	100%	283	-	509	1080	-	2290	**22%**
Thallium	0 / 10	0%	0 / 19	0%	ND(0.1	-	0.1)	ND(0.1	-	1.8)	
Vanadium	1 / 10	10%	1 / 19	5%	0.79	-	0.79	0.8	-	0.8	**99%**
Zinc	10 / 10	100%	19 / 19	100%	3.4	-	6.1	12.1	-	29.6	**21%**
PCB 1260	0 / 10	0%	5 / 19	26%	ND(0.048	-	0.1)	0.061	-	0.33	
DDD, p,p'-	0 / 10	0%	10 / 19	53%	ND(0.0095	-	0.021)	0.012	-	0.11	
DDE, p,p'-	2 / 10	20%	13 / 19	68%	0.015	-	0.031	0.015	-	0.38	**8%**
DDT, p,p'-	0 / 10	0%	3 / 19	16%	ND(0.0095	-	0.021)	0.012	-	0.014	

	Fillet	Whole Body
Average Percent Detected	**33%**	**52%**

Percentile:	Number of Chemicals		
0-25%	**10**	**Avg**	**34%**
26-50%	**2**	**Min**	**0%**
51-75%	**1**	**Max**	**148%**
76-100%	**1**	**Median**	**21%**
>100%	**1**		

TABLE 2-4
SAMPLE SUMMARY FOR BASELINE HUMAN HEALTH RISK ASSESSMENT
GROVE POND/PLOW SHOP POND

Location	Sample No	Date	Analyses	Source Id.
Near-shore Sediment				
Grove Pond	1SC1	8/1/1999	Metals	Reference 54
Grove Pond	1SC2	8/1/1999	Metals	Reference 54
Grove Pond	1SC3	8/1/1999	Metals	Reference 54
Grove Pond	3SC2	8/1/1999	Metals	Reference 54
Grove Pond	3SC3	8/1/1999	Metals	Reference 54
Grove Pond	4SC1	8/1/1999	Metals	Reference 54
Grove Pond	5SC2	8/1/1999	Metals	Reference 54
Grove Pond	6SC1	8/1/1999	Metals	Reference 54
Grove Pond	8SC1	8/1/1999	Metals	Reference 54
Grove Pond	BHSO3	8/1/1999	Metals	Reference 54
Grove Pond	BM 1	1/1/1992	Metals	Reference 32 (Table 1)
Grove Pond	BM 2	1/1/1992	Metals	Reference 32 (Table 1)
Grove Pond	BM 3	1/1/1992	Metals	Reference 32 (Table 1)
Grove Pond	BM 4	1/1/1992	Metals	Reference 32 (Table 1)
Grove Pond	GP01	3/1/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Grove Pond	GP05	3/1/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Grove Pond	GP07	3/1/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Grove Pond	GP09	3/1/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Grove Pond	GP11	3/1/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Grove Pond	GP12	3/2/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Grove Pond	GP13	3/2/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Grove Pond	GP14	3/2/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Grove Pond	GP15	3/2/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Grove Pond	GP15 Dup	3/2/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Grove Pond	GPCORE1	9/1/2000	Metals	Reference 54
Grove Pond	GPCORE2	9/1/2000	Metals	Reference 54
Grove Pond	GPCORE3	9/1/2000	Metals	Reference 54
Grove Pond	GRD-92-01X	1/1/1992	Metals	Reference 6 (Table 4-13)
Grove Pond	GRD-92-02X	1/1/1992	Metals	Reference 6 (Table 4-13)
Grove Pond	GRD-92-03X	1/1/1992	Metals	Reference 6 (Table 4-13)
Grove Pond	GRD-92-04X	1/1/1992	Metals	Reference 6 (Table 4-13)
Grove Pond	GRD-92-05X	1/1/1992	Metals	Reference 6 (Table 4-13)
Grove Pond	GRD-95-08X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-09X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-12X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-15X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-16X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-17X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-19X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-20X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-22X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-23X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-24X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-24X Dup	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-25X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-26X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-27X	4/1/1995	Metals, Mercury, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-28X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-29X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-30X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-31X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-32X	4/1/1995	Metals, Mercury, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-32X Dup	4/1/1995	Metals, Mercury, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-35X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-36X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-37X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-38X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-39X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-40X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-41X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-42X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-43X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-44X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-45X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-46X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-47X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-48X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-49X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)

TABLE 2-4
SAMPLE SUMMARY FOR BASELINE HUMAN HEALTH RISK ASSESSMENT
GROVE POND/PLOW SHOP POND

Location	Sample No	Date	Analyses	Source Id.
Grove Pond	GRD-95-53X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-54X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRD-95-55X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-2)
Grove Pond	GRS-95-01X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-02X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-03X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-04X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-05X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-06X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-07X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-08X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-08X Dup	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-09X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-10X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-11X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-12X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-13X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-14X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	GRS-95-15X	4/1/1995	Metals, PCBs/Pesticides, SVOCs	Reference 21 (Table 4-4)
Grove Pond	G-SED-1	2/2/2005	Metals, PCBs/Pesticides, PAHs	ongoing EPA Grove Pond/Plow shop Pond study
Grove Pond	G-SED-3	2/2/2005	Metals, PCBs/Pesticides, PAHs	ongoing EPA Grove Pond/Plow shop Pond study
Grove Pond	G-SED-3 Dup	2/2/2005	Metals, PCBs/Pesticides, PAHs	ongoing EPA Grove Pond/Plow shop Pond study
Grove Pond	GSEM-1	9/11/1998	Metals	Reference 38 & 39
Grove Pond	GSEM-2	9/11/1998	Metals	Reference 38 & 39
Grove Pond	GSEM-4	9/11/1998	Metals	Reference 38 & 39
Grove Pond	GV1	1/1/2001	Metals	Reference 54
Grove Pond	GV10	1/1/2001	Metals	Reference 54
Grove Pond	GV5	1/1/2001	Metals	Reference 54
Grove Pond	GV6	1/1/2001	Metals	Reference 54
Grove Pond	GV7	1/1/2001	Metals	Reference 54
Grove Pond	GV8	1/1/2001	Metals	Reference 54
Grove Pond	GV9	1/1/2001	Metals	Reference 54
Grove Pond	MADEP A	1/1/1992	Metals	Reference 32 (Table 1)
Grove Pond	MADEP B	1/1/1992	Metals	Reference 32 (Table 1)
Grove Pond	MADEP C	1/1/1992	Metals	Reference 32 (Table 1)
Grove Pond	MADEP D	1/1/1992	Metals	Reference 32 (Table 1)
Grove Pond	MADEP E	1/1/1992	Metals	Reference 32 (Table 1)
Grove Pond	MADEP F	1/1/1992	Metals	Reference 32 (Table 1)
Grove Pond	PZ-1	8/4/1999	Metals, PCBs/Pesticides, SVOCs	Reference 40
Grove Pond	PZ-2	8/4/1999	Metals, PCBs/Pesticides, SVOCs	Reference 40
Grove Pond	S-1	12/22/1993	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 6
Grove Pond	S-2	12/22/1993	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 6
Grove Pond	S-3	12/22/1993	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 6
Grove Pond	S-4	12/22/1993	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 6
Grove Pond	SD-01	8/1/1999	Metals	Reference 54
Grove Pond	SD-03	8/1/1999	Metals	Reference 54
Grove Pond	SD-05	8/1/1999	Metals	Reference 54
Grove Pond	SD-06	8/1/1999	Metals	Reference 54
Grove Pond	SD-07	8/1/1999	Metals	Reference 54
Grove Pond	SD-08	8/1/1999	Metals	Reference 54
Grove Pond	SED-A	10/2/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SED-B	10/1/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SED-C	10/2/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SED-D	10/1/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SED-E	10/1/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SED-F	10/1/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SED-G	10/1/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SEDIMENT 1	4/29/1994	PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SEDIMENT 3	4/29/1994	PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SEDIMENT 4	4/29/1994	PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SEDIMENT 5	4/29/1994	PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SEDIMENT 6	4/29/1994	PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SEDIMENT 7	4/29/1994	PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SW-1	12/22/1993	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 8
Grove Pond	SW-2	12/22/1993	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 8
Grove Pond	SW-3	12/22/1993	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 8
Grove Pond	SW-4	12/22/1993	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 8
Plow Shop Pond	PS1	1/1/2001	Metals	Reference 54
Plow Shop Pond	PS2	1/1/2001	Metals	Reference 54

TABLE 2-4
SAMPLE SUMMARY FOR BASELINE HUMAN HEALTH RISK ASSESSMENT
GROVE POND/PLOW SHOP POND

Location	Sample No	Date	Analyses	Source Id.
Plow Shop Pond	PS4	1/1/2001	Metals	Reference 54
Plow Shop Pond	PS5	1/1/2001	Metals	Reference 54
Plow Shop Pond	PS7	1/1/2001	Metals	Reference 54
Plow Shop Pond	PS8	1/1/2001	Metals	Reference 54
Plow Shop Pond	PS9	1/1/2001	Metals	Reference 54
Plow Shop Pond	P-SED-1	2/1/2005	Metals, PCBs/Pesticides, PAHs	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	P-SED-11	2/1/2005	Metals, PCBs/Pesticides, PAHs	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	P-SED-2	2/1/2005	Metals, PCBs/Pesticides, PAHs	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	P-SED-3	2/1/2005	Metals, PCBs/Pesticides, PAHs	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	P-SED-4	2/1/2005	Metals, PCBs/Pesticides, PAHs	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	P-SED-8	2/1/2005	Metals, PCBs/Pesticides, PAHs	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	P-SED-9	2/1/2005	Metals, PCBs/Pesticides, PAHs	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PSEM-1	9/11/1998	Metals	Reference 38 & 39
Plow Shop Pond	PSEM-2	9/11/1998	Metals	Reference 38 & 39
Plow Shop Pond	PSEM-3	9/11/1998	Metals	Reference 38 & 39
Plow Shop Pond	PSP02	3/2/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PSP02 Dup	3/2/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PSP03	3/2/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PSP05	3/3/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PSP06	3/3/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PSP07	3/3/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PSP08	3/3/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PSP09	3/3/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PSPC05	3/5/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PSPC06	3/5/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PSPC06 Dup	3/5/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PSPC09	3/3/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PSPC10	3/3/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PSPC11	3/4/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PSPC12	3/4/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PSPC13	3/4/2004	Metals, VOCs	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PSPC14	3/4/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PSPC15	3/5/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PSPC16	3/5/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PSPC17	3/5/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PSPC17 Dup	3/5/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PSPC18	3/5/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PSPC19	3/5/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PSPC19 Dup	3/5/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PSPCORE1	9/1/2000	Metals	Reference 54
Plow Shop Pond	PSPCORE2	9/1/2000	Metals	Reference 54
Plow Shop Pond	PSPCORE3	9/1/2000	Metals	Reference 54
Plow Shop Pond	RHD-94-02X	1/1/1994	Metals, PAHs	Reference 20
Plow Shop Pond	RHD-94-03X	1/1/1994	Metals, PAHs	Reference 20
Plow Shop Pond	RHD-94-03X Dup	1/1/1994	Metals, PAHs	Reference 20
Plow Shop Pond	RHD-94-04X	1/1/1994	Metals, PAHs	Reference 20
Plow Shop Pond	RHD-94-05X	1/1/1994	Metals, PAHs	Reference 20
Plow Shop Pond	SESHL01	1/1/1991	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 21 (Table 1-2)
Plow Shop Pond	SESHL02	1/1/1991	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 21 (Table 1-2)
Plow Shop Pond	SESHL03	1/1/1991	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 21 (Table 1-2)
Plow Shop Pond	SESHL04	1/1/1991	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 21 (Table 1-2)
Plow Shop Pond	SESHL05	1/1/1991	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 21 (Table 1-2)
Plow Shop Pond	SESHL06	1/1/1991	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 21 (Table 1-2)
Plow Shop Pond	SESHL07	1/1/1991	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 21 (Table 1-2)
Plow Shop Pond	SESHL08	1/1/1991	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 21 (Table 1-2)
Plow Shop Pond	SESHL09	1/1/1991	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 21 (Table 1-2)
Plow Shop Pond	SESHL10	1/1/1991	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 21 (Table 1-2)
Plow Shop Pond	SESHL11	1/1/1991	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 21 (Table 1-2)
Plow Shop Pond	SESHL12	1/1/1991	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 21 (Table 1-2)
Plow Shop Pond	SHD-92-01X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-02X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-03X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-03X Dup	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-05X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-06X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-10X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-11X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-17X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-18X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)

TABLE 2-4
SAMPLE SUMMARY FOR BASELINE HUMAN HEALTH RISK ASSESSMENT
GROVE POND/PLOW SHOP POND

Location	Sample No	Date	Analyses	Source Id.
Plow Shop Pond	SHD-92-19X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-20X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-22X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-23X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-26X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-27X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-28X	1/1/1992	Metals, PCBs/Pesticides	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-29X	1/1/1993	Metals, PCBs/Pesticides, VOCs	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-30X	1/1/1993	Metals, PCBs/Pesticides, VOCs	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-31X	1/1/1993	Metals, PCBs/Pesticides, VOCs	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-92-32X	1/1/1993	Metals, PCBs/Pesticides, VOCs	Reference 6 (Table 4-5)
Plow Shop Pond	SHD-94-01X	4/1/1995	Metals	Reference 21 (Table 4-6)
Plow Shop Pond	SHD-94-02X	4/1/1995	Metals	Reference 21 (Table 4-6)
Plow Shop Pond	SHD-94-03X	4/1/1995	Metals	Reference 21 (Table 4-6)
Plow Shop Pond	SHD-94-05X	4/1/1995	Metals	Reference 21 (Table 4-6)
Plow Shop Pond	SHD-94-06X	4/1/1995	Metals	Reference 21 (Table 4-6)
Plow Shop Pond	SHD-94-07X	4/1/1995	Metals	Reference 21 (Table 4-6)
Plow Shop Pond	SHD-94-09X	4/1/1995	Metals	Reference 21 (Table 4-6)
Plow Shop Pond	SHD-94-14X	4/1/1995	Metals	Reference 21 (Table 4-6)
Plow Shop Pond	SHD-94-15X	4/1/1995	Metals	Reference 21 (Table 4-6)
Plow Shop Pond	SHD-94-18X	4/1/1995	Metals	Reference 21 (Table 4-6)
Plow Shop Pond	SHD-94-20X	4/1/1995	Metals	Reference 21 (Table 4-6)
Surface Water				
Grove Pond	G1-2004	11/3/2004	Metals, PCBs/Pesticides	ongoing EPA Grove Pond/Plow shop Pond study
Grove Pond	G2-2004	11/3/2004	Metals, PCBs/Pesticides	ongoing EPA Grove Pond/Plow shop Pond study
Grove Pond	G2-2004 Dup	11/3/2004	Metals, PCBs/Pesticides	ongoing EPA Grove Pond/Plow shop Pond study
Grove Pond	G3-2004	11/3/2004	Metals, PCBs/Pesticides	ongoing EPA Grove Pond/Plow shop Pond study
Grove Pond	G4-2004	11/3/2004	Metals, PCBs/Pesticides	ongoing EPA Grove Pond/Plow shop Pond study
Grove Pond	G5-2004	11/3/2004	Metals, PCBs/Pesticides	ongoing EPA Grove Pond/Plow shop Pond study
Grove Pond	G6-2004	11/3/2004	Metals, PCBs/Pesticides	ongoing EPA Grove Pond/Plow shop Pond study
Grove Pond	GRW-95-06X	4/1/1995	Metals	Reference 21 (Table 4-5)
Grove Pond	GRW-95-07X	4/1/1995	Metals	Reference 21 (Table 4-5)
Grove Pond	GRW-95-08X	4/1/1995	Metals	Reference 21 (Table 4-5)
Grove Pond	GRW-95-09X	4/1/1995	Metals	Reference 21 (Table 4-5)
Grove Pond	GRW-95-09X Dup	4/1/1995	Metals	Reference 21 (Table 4-5)
Grove Pond	GRW-95-10X	4/1/1995	Metals	Reference 21 (Table 4-5)
Grove Pond	GRW-95-11X	4/1/1995	Metals	Reference 21 (Table 4-5)
Grove Pond	GSEM-1	9/9/1998	Metals	Reference 38 & 39
Grove Pond	GSEM-2	9/9/1998	Metals	Reference 38 & 39
Grove Pond	GSEM-3	9/9/1998	Metals	Reference 38 & 39
Grove Pond	GSEM-4	9/9/1998	Metals	Reference 38 & 39
Grove Pond	PZ-1	8/12/1999	Metals	Reference 40
Grove Pond	PZ-1R	11/18/1999	Metals	Reference 40
Grove Pond	PZ-2	8/16/1999	Metals	Reference 40
Grove Pond	PZ-2R	11/19/1999	Metals	Reference 40
Grove Pond	SW001	8/25/1998	Metals	Reference 54
Grove Pond	SW001F	8/25/1998	Metals, Chloride, Sulfate	Reference 54
Grove Pond	SW002	8/25/1998	Metals	Reference 54
Grove Pond	SW002F	8/25/1998	Metals, Chloride, Sulfate	Reference 54
Grove Pond	SW003	8/25/1998	Metals	Reference 54
Grove Pond	SW003F	8/25/1998	Metals, Chloride, Sulfate	Reference 54
Grove Pond	SW004	8/25/1998	Metals	Reference 54
Grove Pond	SW004F	8/25/1998	Metals, Chloride, Nitrate, Sulfate	Reference 54
Grove Pond	SW005	8/25/1998	Metals	Reference 54
Grove Pond	SW005F	8/25/1998	Metals, Chloride, Sulfate	Reference 54
Grove Pond	SW006	8/25/1998	Metals	Reference 54
Grove Pond	SW006F	8/25/1998	Metals, Chloride, Sulfate	Reference 54
Grove Pond	SW008	8/25/1998	Metals	Reference 54
Grove Pond	SW008	2/24/1999	Metals, Chloride, Nitrate, Sulfate	Reference 54
Grove Pond	SW-1	12/22/1993	Metals, Chloride, Nitrate, Sulfate, PCBs/Pesticides, SVOCs, VOCs	Reference 8
Grove Pond	SW-1 PDC	11/18/1999	Metals	Reference 8
Grove Pond	SW-2	12/22/1993	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 8
Grove Pond	SW-2 PDC	11/18/1999	Metals	Reference 8
Grove Pond	SW-3	12/22/1993	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 8
Grove Pond	SW-4	12/22/1993	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 8
Grove Pond	SW-A	10/1/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SW-B	10/1/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SW-C	10/1/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11

TABLE 2-4
SAMPLE SUMMARY FOR BASELINE HUMAN HEALTH RISK ASSESSMENT
GROVE POND/PLOW SHOP POND

Location	Sample No	Date	Analyses	Source Id.
Grove Pond	SW-D	10/1/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SW-E	10/1/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SW-F	10/1/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11
Grove Pond	SW-G	10/1/1992	Metals, PCBs/Pesticides, SVOCs, VOCs	Reference 11
Plow Shop Pond	PS1-2004	11/3/2004	Metals, PCBs/Pesticides	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PS2-2004	11/3/2004	Metals, PCBs/Pesticides	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PS3-2004	11/3/2004	Metals, PCBs/Pesticides	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PS4-2004	11/3/2004	Metals, PCBs/Pesticides	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PS5-2004	11/3/2004	Metals, PCBs/Pesticides	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PS6-2004	11/3/2004	Metals, PCBs/Pesticides	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	PSEM-1	9/11/1998	Metals	Reference 38 & 39
Plow Shop Pond	PSEM-2	9/11/1998	Metals	Reference 38 & 39
Plow Shop Pond	PSEM-3	9/11/1998	Metals	Reference 38 & 39
Plow Shop Pond	PSEM-4	9/11/1998	Metals	Reference 38 & 39
Plow Shop Pond	RCSW1	11/19/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	RCSW2	11/19/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	RCSW3	11/19/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	RCSW4	11/19/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	RED COVE	7/16/2004	Metals	ongoing EPA Grove Pond/Plow shop Pond study
Plow Shop Pond	SW-SHL-01	1/1/1991	Metals, PCBs/Pesticides, VOCs	Reference 21 (Table 1-1)
Plow Shop Pond	SW-SHL-02	1/1/1991	Metals, PCBs/Pesticides, VOCs	Reference 21 (Table 1-1)
Plow Shop Pond	SW-SHL-03	1/1/1991	Metals, PCBs/Pesticides, VOCs	Reference 21 (Table 1-1)
Plow Shop Pond	SW-SHL-04	1/1/1991	Metals, PCBs/Pesticides, VOCs	Reference 21 (Table 1-1)
Plow Shop Pond	SW-SHL-05	1/1/1991	Metals, PCBs/Pesticides, VOCs	Reference 21 (Table 1-1)
Plow Shop Pond	SW-SHL-06	1/1/1991	Metals, PCBs/Pesticides, VOCs	Reference 21 (Table 1-1)
Plow Shop Pond	SW-SHL-07	1/1/1991	Metals, PCBs/Pesticides, VOCs	Reference 21 (Table 1-1)
Plow Shop Pond	SW-SHL-08	1/1/1991	Metals, PCBs/Pesticides, VOCs	Reference 21 (Table 1-1)
Plow Shop Pond	SW-SHL-09	1/1/1991	Metals, PCBs/Pesticides, VOCs	Reference 21 (Table 1-1)
Plow Shop Pond	SW-SHL-10	1/1/1991	Metals, PCBs/Pesticides, VOCs	Reference 21 (Table 1-1)
Plow Shop Pond	SW-SHL-11	1/1/1991	Metals, PCBs/Pesticides	Reference 21 (Table 1-1)
Plow Shop Pond	SW-SHL-12	1/1/1991	Metals, PCBs/Pesticides, VOCs	Reference 21 (Table 1-1)
Plow Shop Pond	SW-SHL-13	1/1/1991	Metals, PCBs/Pesticides, VOCs	Reference 21 (Table 1-1)
Fish Tissue (fillets)				
Grove Pond	BBH1F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	BBH2F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	BBH3F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	BBH6F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	LMB10F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	LMB1F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	LMB2F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	LMB3F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	LMB4F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	LMB5F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	LMB6F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	LMB7F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	LMB8F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	LMB9F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	YBH4F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	YBH5F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	YBH7F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Grove Pond	YBH8F	9/25/1992	Metals, PCBs/Pesticides, SVOCs	Reference 5
Plow Shop Pond	PSP05F	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP06F	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP07F	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP07F2	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP12F	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP17F	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP17F2	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP18F	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP18F2	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP19F	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP19F2	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP20F	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP20F2	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP22F	10/20/1992	Metals, PCBs/Pesticides	Reference 6
Plow Shop Pond	PSP23F	10/20/1992	Metals, PCBs/Pesticides	Reference 6

TABLE 2-4
SAMPLE SUMMARY FOR BASELINE HUMAN HEALTH RISK ASSESSMENT
GROVE POND/PLOW SHOP POND

Location	Sample No	Date	Analyses	Source Id.
REFERENCES:				
Number	**Date**	**Company**	**Title**	**Prepared for:**
5	01-Sep-93	US Fish and Wildlife	Concentrations of Mercury and other Environmental Contaminants in Fish from Grove Pond, Ayer, Massachusetts	
6	01-Dec-93	ABB-ES, Inc.	Final Remedial Investigation Addendum Report, Data Item A009, Volume I of IV, Report Text	US Army Environmental Center
8	01-Apr-94	ERM	Site Assessment Report, Boston & Maine Railroad Property, Fort Devens, Ayer, Massachusetts	Boston & Maine Corporation
11	01-Dec-94		Grove Pond Field Investigation	Metcalf & Eddy for MADEP
20	01-Sep-95	ABB-ES, Inc.	Railroad Roundhouse Supplemental Site Investigation, Data Item A009	US Army Environmental Center
21	01-Oct-95	ABB-ES, Inc.	Draft Plow Shop Pond and Grove Pond Sediment Evaluation, Data Item A009	US Army Environmental Center
32	01-Dec-97	TRC Environmental Corporation	Plow Shop Pond and Grove Pond Ecological Impact Evaluation, Fort Devens, Massachusetts	MADEP
38	01-Nov-98	EPA	Surface Water & Sediment Sampling Fort Devens Superfund Site Ayer, MA	ESAT
39	21-Jun-05	USEPA Region 1	USEPA Screening Level Ecological Risk Assessment, Fort Devens, Ayer, Massachusetts	
40	21-Oct-99	Environmental Compliance Services	Field Work and Analytical Results, PDC, Ayers	
54	01-May-99		Phase I Work Plan through March 2002 Grove Pond Arsenic Investigation	

TABLE 2-5

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

RAGS D TABLE 2

GROVE POND

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value (3)	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Near-shore Sediment	7429-90-5	Aluminum	1.1	90000	mg/kg	GRD-95-42X	119-119		90000	N/A	7600 (N)	N/A		**Yes**	ASL
	7440-36-0	Antimony	5	49.2	mg/kg	PZ-1	14-106	0.03-700	49	N/A	3.1 (N)	N/A		**Yes**	ASL
	7440-38-2	Arsenic	2.86	1300	mg/kg	GRD-95-26X	121-131	3.12-90	1300	N/A	0.39 (C)	N/A		**Yes**	ASL
	7440-39-3	Barium	7.4	470	mg/kg	GRD-95-27X	101-117	5.18-70	470	N/A	537 (N)	N/A		No	BSL
	7440-41-7	Beryllium	0.5	14.1	mg/kg	GRD-95-45X	31-111	0.5-14	14	N/A	15 (N)	N/A		No	BSL
	7440-43-9	Cadmium	0.489	730	mg/kg	BM 2	64-124	0.7-16	730	N/A	3.7 (N)	N/A		**Yes**	ASL
	7440-70-2	Calcium	0.51	170000	mg/kg	G-SED-3 Dup	104-104		170000	N/A	ND	N/A		No	NUT
	7440-47-3	Chromium, total	4.69	52000	mg/kg	GP15	125-130	4.05-28	52000	N/A	22 (N) [a]	N/A		**Yes**	ASL
	7440-48-4	Cobalt	2.29	70	mg/kg	SED-G	73-114	1.42-28	70	N/A	140 (N)	N/A		No	BSL
	7440-50-8	Copper	2.61	13000	mg/kg	BM 2	117-121	3-28	13000	N/A	310 (N)	N/A		**Yes**	ASL
	7439-89-6	Iron	2	42800	mg/kg	GRD-95-44X	119-119		42800	N/A	2300 (N)	N/A		**Yes**	ASL
	7439-92-1	Lead	3.29	1760	mg/kg	GRD-95-31X	122-130	10-70	1760	N/A	400 (X)	N/A		**Yes**	ASL
	7439-95-4	Magnesium	184	5300	mg/kg	GRD-95-41X	95-104	100-373	5300	N/A	ND	N/A		No	NUT
	7439-96-5	Manganese	0.39	2500	mg/kg	G-SED-3 Dup	122-122		2500	N/A	180 (N)	N/A		**Yes**	ASL
	7439-97-6	Mercury	0.0245	422	mg/kg	GRD-95-44X	84-108	0.05-1.8	422	N/A	2.3 (N)	N/A		**Yes**	ASL
	7440-02-0	Nickel	1.98	69.9	mg/kg	GRD-95-42X	105-119	1.71-70	69.9	N/A	160 (N)	N/A		No	BSL
	7440-09-7	Potassium	100	4120	mg/kg	SD-08	48-104	100-5600	4120	N/A	ND	N/A		No	NUT
	7782-49-2	Selenium	0.424	41.2	mg/kg	SD-08	39-114	0.25-100	41.2	N/A	39 (N)	N/A		**Yes**	ASL
	7440-22-4	Silver	0.792	12.4	mg/kg	SD-08	13-63	0.589-16	12.4	N/A	39 (N)	N/A		No	BSL
	7440-23-5	Sodium	100	6370	mg/kg	GRD-95-31X	79-104	98-5600	6370	N/A	ND	N/A		No	NUT
	7440-28-0	Thallium	0.1	82.4	mg/kg	SD-08	20-95	0.1-110	82.4	N/A	0.52 (N)	N/A		**Yes**	ASL
	7440-62-2	Vanadium	5.1	140	mg/kg	GP14, GP15	92-115	2.8-65.9	140	N/A	7.8 (N)	N/A		**Yes**	ASL
	7440-66-6	Zinc	3.12	770	mg/kg	GP12	116-123	8.03-8.03	770	N/A	2300 (N)	N/A		No	BSL
	22967926	Mercury, methyl	0.00028	0.07044	mg/kg	GV5	9-9		0.07044	N/A	0.61 (N)	N/A		No	BSL
	83-32-9	Acenaphthene	0.019	1.3	mg/kg	GRS-95-11X	4-40	0.036-2	1.3	N/A	370 (N)	N/A		No	BSL
	208-96-8	Acenaphthylene	0.048	0.22	mg/kg	G-SED-1	4-83	0.033-2	0.22	N/A	370 (N) [b]	N/A		No	FREQ
	120-12-7	Anthracene	0.081	2.4	mg/kg	GRD-95-15X	10-83	0.033-2	2.4	N/A	2200 (N)	N/A		No	BSL
	56-55-3	Benz(a)anthracene	0.19	3.4	mg/kg	GRD-95-15X	9-83	0.13-7	3.4	N/A	0.62 (C)	N/A		**Yes**	ASL
	50-32-8	Benzo(a)pyrene	0.37	2.3	mg/kg	GRS-95-11X	7-40	0.13-2.7	2.3	N/A	0.062 (C)	N/A		**Yes**	ASL
	205-99-2	Benzo(b)fluoranthene	0.075	5	mg/kg	GRS-95-07X	6-75	0.13-8	5	N/A	0.62 (C)	N/A		**Yes**	ASL
	191-24-2	Benzo(ghi)perylene	0.084	1.4	mg/kg	SW-1	4-40	0.13-3.6	1.4	N/A	230 (N) [c]	N/A		No	BSL
	207-08-9	Benzo(k)fluoranthene	0.21	4.9	mg/kg	SW-1	12-83	0.066-3	4.9	N/A	6.2 (C)	N/A		**Yes**	PAHc
	218-01-9	Chrysene	0.051	5	mg/kg	GRS-95-07X	14-83	0.12-5	5	N/A	62 (C)	N/A		**Yes**	PAHc

TABLE 2-5
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
RAGS D TABLE 2
GROVE POND

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value (3)	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Near-shore Sediment	53-70-3	Dibenz(ah)anthracene	0.03	0.73	mg/kg	G-SED-3 Dup	2-25	0.13-3.4	0.73	N/A	0.062 (C)	N/A		**Yes**	ASL
	206-44-0	Fluoranthene	0.06	7.1	mg/kg	SW-1	21-83	0.068-3	7.1	N/A	230 (N)	N/A		No	BSL
	86-73-7	Fluorene	0.049	1.1	mg/kg	GRD-95-15X, GRS-95-11X	5-83	0.033-2	1.1	N/A	270 (N)	N/A		No	BSL
	193-39-5	Indeno(1,2,3-cd)pyrene	0.037	2.9	mg/kg	G-SED-3 Dup	4-40	0.13-3.4	2.9	N/A	0.62 (C)	N/A		**Yes**	ASL
	90-12-0	Methylnaphthalene, 1-	1.1	1.1	mg/kg	S-2	1-15	0.5-5	1.1	N/A	5.6 (N) [d]	N/A		No	BSL
	91-57-6	Methylnaphthalene, 2-	0.47	4	mg/kg	GRD-95-12X	9-81	0.049-2	4	N/A	5.6 (N) [d]	N/A		No	BSL
	91-20-3	Naphthalene	0.034	30	mg/kg	GRD-95-26X	23-83	0.037-2	30	N/A	5.6 (N)	N/A		**Yes**	ASL
	85-01-8	Phenanthrene	0.043	7.7	mg/kg	GRS-95-11X	23-83	0.033-2	7.7	N/A	2200 (N) [e]	N/A		No	BSL
	129-00-0	Pyrene	0.059	6.5	mg/kg	GRS-95-11X	28-83	0.03-2	6.5	N/A	230 (N)	N/A		No	BSL
	72-54-8	DDD, p,p'-	0.0087 (C)	2.5 (C)	mg/kg	GRD-95-47X	40-84	0.0083-0.36	2.5	N/A	2.4 (C)	N/A		**Yes**	ASL
	72-55-9	DDE, p,p'-	0.01	0.98 (C,M)	mg/kg	GRD-95-31X, GRD-95-31X	39-84	0.0034-0.36	0.98	N/A	1.7 (C)	N/A		No	BSL
	50-29-3	DDT, p,p'-	0.01	1.5 (C,M)	mg/kg	GRD-95-29X	16-84	0.0033-0.36	1.5	N/A	1.7 (C)	N/A		No	BSL
	72-20-8	Endrin	0.028	0.028	mg/kg	GRD-95-31X	1-69	0.0033-0.36	0.028	N/A	1.8 (N)	N/A		No	FREQ
	100-51-6	Benzyl alcohol	1.7	19	mg/kg	GRS-95-11X	2-23	0.19-4.1	19	N/A	1800 (N)	N/A		No	BSL
	117-81-7	Bis(2-ethylhexyl) phthalate	0.41	4.9	mg/kg	PZ-1	2-15	0.13-2	4.9	N/A	35 (C)	N/A		No	BSL
	101-55-3	Bromophenyl phenyl ether, 4-	1.7	1.7	mg/kg	GRD-95-15X	1-58	0.033-2	1.7	N/A	ND	N/A		No	FREQ
	85-68-7	Butylbenzyl phthalate	3	3	mg/kg	GRD-95-15X	1-51	0.13-7	3	N/A	1200 (N)	N/A		No	FREQ
	7005-72-3	Chlorophenyl phenyl ether, 4-	0.84	0.84	mg/kg	GRD-95-15X	1-58	0.033-2	0.84	N/A	ND	N/A		No	FREQ
	132-64-9	Dibenzofuran	0.063	0.7	mg/kg	GRS-95-07X	6-66	0.035-9.8	0.7	N/A	15 (N)	N/A		No	BSL
	84-74-2	Di-n-butyl phthalate	3.3	8	mg/kg	GRS-95-09X	2-73	0.061-3	8	N/A	610 (N)	N/A		No	FREQ
	118-74-1	Hexachlorobenzene	1.7	1.7	mg/kg	GRD-95-15X	1-58	0.033-2	1.7	N/A	0.30 (C)	N/A		No	FREQ
	108-88-3	Toluene	0.0042	0.0042	mg/kg	SEDIMENT 3	1-21	0.002-0.054	0.0042	N/A	66 (N)	N/A		No	FREQ
	1330-20-7	Xylenes, total	0.0164	0.0164	mg/kg	SEDIMENT 1	1-21	0.002-0.036	0.0164	N/A	27 (N)	N/A		No	FREQ

Notes:
(1) Minimum/maximum concentration in data determined to be useable for risk assessment.
Qualifiers: C = unknown
M = unknown
(2) Screening concentration = maximum detected concentration.
(3) Chemicals will not be screened out of or re-included in the risk assessment based on background concentrations or ARARs/TBCs.
(4) U.S. EPA Region IX Preliminary Remedial Goals (PRGs) for residential soil, December 28, 2004.
Value Type: C = carcinogenic (target risk = 1e-6).
N = noncarcinogenic (target HI = 0.1)
X = special health-based value not based on carcinogenic/noncarcinogenic endpoints.

Definitions: ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.
COPC = Chemical of Potential Concern.
N/A = not applicable.
ND = not determined.

TABLE 2-5

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

RAGS D TABLE 2

GROVE POND

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value (3)	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)

(5) Rationale Codes
Selection Reason: ASL = above screening level.
PAHc = carcinogenic PAH (although screening concentration < screening toxicity value, included as COPC due to the cumulative nature of carcinogenic PAHs).
Deletion Reason: BSL = below screening level.
FREQ = frequency of detection (chemical detected in less than 5 percent of samples).
NUT = essential nutrient.

Additional Notes:
[a] PRG for hexavalent chromium.
[b] PRG for acenaphthene used as a surrogate.
[c] PRG for pyrene used as a surrogate.
[d] PRG for naphthalene used as a surrogate.
[e] PRG for anthracene used as a surrogate.

TABLE 2-6
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
RAGS D TABLE 2
GROVE POND

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value (3)	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Surface Water	7429-90-5	Aluminum	0.008 (J)	0.176	mg/L	SW001	15-24	0.05-10	0.176	N/A	3.6 (N)	N/A		No	BSL
	7440-38-2	Arsenic	0.000001	0.128	mg/L	PZ-2	18-34	0.00254-10	0.128	N/A	0.000045 (C)	N/A		**Yes**	ASL
	7440-39-3	Barium	0.00637	11.9	mg/L	GSEM-2	22-30	0.005-0.01	11.9	N/A	0.26 (N)	N/A		**Yes**	ASL
	7440-70-2	Calcium	0.0088	19700	mg/L	GSEM-2	30-30		19700	N/A	ND	N/A		No	NUT
	7440-47-3	Chromium, total	0.0008 (J)	0.175	mg/L	PZ-1R	12-34	0.003-3	0.175	N/A	0.011 (N) [a]	N/A		**Yes**	ASL
	7440-48-4	Cobalt	0.00028	0.00043	mg/L	G6-2004	3-24	0.0002-1.5	0.00043	N/A	0.073 (N)	N/A		No	BSL
	7440-50-8	Copper	0.001 (J)	0.032	mg/L	G2-2004 Dup	8-34	0.0015-1.5	0.032	N/A	0.15 (N)	N/A		No	BSL
	7439-89-6	Iron	0.00012	390	mg/L	GSEM-1	30-30		390	N/A	1.1 (N)	N/A		**Yes**	ASL
	7439-92-1	Lead	0.0003 (J)	0.027	mg/L	PZ-1	10-34	0.001-5	0.027	N/A	ND	N/A		**Yes**	NSL
	7439-95-4	Magnesium	0.0017	3300	mg/L	GSEM-2	30-30		3300	N/A	ND	N/A		No	NUT
	7439-96-5	Manganese	0.01	268	mg/L	GSEM-2	30-30		268	N/A	0.088 (N)	N/A		**Yes**	ASL
	7439-97-6	Mercury	0.0011	0.0011	mg/L	PZ-1	1-23	0.0005-0.001	0.0011	N/A	0.0011 (N)	N/A		No	FREQ
	7440-02-0	Nickel	0.001	0.032	mg/L	PZ-1R	7-28	0.005-6	0.032	N/A	0.073 (N)	N/A		No	BSL
	14797-55-8	Nitrate	0.07	0.3	mg/L	SW-1	3-3		0.3	N/A	1.0 (N)	N/A		No	BSL
		Nitrogen, NO2+NO3	0.0195	0.26	mg/L	GRW-95-10X	5-6	0.01-0.01	0.26	N/A	0.1 (N) [b]	N/A		**Yes**	ASL
	7440-09-7	Potassium	0.0013	2500	mg/L	GSEM-1	24-24		2500	N/A	ND	N/A		No	NUT
	7440-23-5	Sodium	0.0224	30500	mg/L	GSEM-1	24-24		30500	N/A	ND	N/A		No	NUT
	7440-66-6	Zinc	0.005 (J)	9.11	mg/L	PZ-1	11-28	0.006-12	9.11	N/A	1.1 (N)	N/A		**Yes**	ASL
	117-81-7	Bis(2-ethylhexyl) phthalate	0.009	0.051	mg/L	GRW-95-06X	6-13	0.0048-0.01	0.051	N/A	0.0048 (C)	N/A		**Yes**	ASL

Notes:
(1) Minimum/maximum concentration in data determined to be useable for risk assessment.
Qualifiers: J = estimated
(2) Screening concentration = maximum detected concentration.
(3) Chemicals will not be screened out of or re-included in the risk assessment based on background concentrations or ARARs/TBCs.
(4) U.S. EPA Region IX Preliminary Remedial Goals (PRGs) for tap water, December 28, 2004.
Value Type: C = carcinogenic (target risk = 1e-6).
N = noncarcinogenic (target HI = 0.1)
(5) Rationale Codes
Selection Reason: ASL = above screening level.
NSL = no screening level available.
Deletion Reason: BSL = below screening level.
FREQ = frequency of detection (chemical detected in less than 5 percent of samples).
NUT = essential nutrient.

Definitions: ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.
COPC = Chemical of Potential Concern.
N/A = not applicable.
ND = not determined.

Additional Notes:
[a] PRG for hexavalent chromium.
[b] PRG for nitrite used as a surrogate.

TABLE 2-7

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

RAGS D TABLE 2

GROVE POND

Scenario Timeframe: Current/Future
Medium: Fish
Exposure Medium: Fish (filet)

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value (3)	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Fish (filet)	7429-90-5	Aluminum	1.45	4.15	mg/kg-ww	BBH1F	18-18		4.15	N/A	140 (N)	N/A		No	BSL
	7440-39-3	Barium	0.098	0.147	mg/kg-ww	YBH7F	5-18	0.08-0.109	0.147	N/A	9.5 (N)	N/A		No	BSL
	7440-41-7	Beryllium	0.033	0.14	mg/kg-ww	LMB3F	4-18	0.016-0.022	0.14	N/A	0.27 (N)	N/A		No	BSL
	7440-42-8	Boron	0.162	0.343	mg/kg-ww	LMB4F	4-18	0.08-0.109	0.343	N/A	27 (N)	N/A		No	BSL
	7440-43-9	Cadmium	0.025	0.151	mg/kg-ww	LMB3F	5-18	0.016-0.022	0.151	N/A	0.14 (N)	N/A		Yes	ASL
	7440-47-3	Chromium, total	0.1	0.488	mg/kg-ww	LMB4F	18-18		0.488	N/A	0.41 (N)[a]	N/A		Yes	ASL
	7440-50-8	Copper	0.111	0.597	mg/kg-ww	YBH8F	18-18		0.597	N/A	5.4 (N)	N/A		No	BSL
	7439-89-6	Iron	2.82	13.9	mg/kg-ww	YBH7F	18-18		13.9	N/A	41 (N)	N/A		No	BSL
	7439-92-1	Lead	0.0983	0.859	mg/kg-ww	LMB4F	8-18	0.0797-0.1076	0.859	N/A	ND	N/A		Yes	NSL
	7439-95-4	Magnesium	214	372	mg/kg-ww	LMB8F	18-18		372	N/A	ND	N/A		No	NUT
	7439-96-5	Manganese	0.0715	1.41	mg/kg-ww	LMB10F	18-18		1.41	N/A	2.7 (N)	N/A		No	BSL
	7439-97-6	Mercury	0.0522	1.04	mg/kg-ww	LMB1F	16-18	0.0176-0.0188	1.04	N/A	0.041 (N)[b]	N/A		Yes	ASL
	7439-98-7	Molybdenum	0.154	0.154	mg/kg-ww	LMB3F	1-18	0.0797-0.1097	0.154	N/A	0.68 (N)	N/A		No	BSL
	7440-02-0	Nickel	0.092	0.607	mg/kg-ww	LMB3F	7-18	0.0797-0.1085	0.607	N/A	2.7 (N)	N/A		No	BSL
	7782-49-2	Selenium	0.0991	0.179	mg/kg-ww	LMB1F	13-18	0.0803-0.0875	0.179	N/A	0.68 (N)	N/A		No	BSL
	7440-24-6	Strontium	0.150	4.24	mg/kg-ww	YBH7F	18-18		4.24	N/A	81 (N)	N/A		No	BSL
	7440-62-2	Vanadium	0.124	0.164	mg/kg-ww	LMB3F	2-18	0.0797-0.1085	0.164	N/A	0.14 (N)	N/A		Yes	ASL
	7440-66-6	Zinc	3.63	7.95	mg/kg-ww	YBH7F	18-18		7.95	N/A	41 (N)	N/A		No	BSL
	1336-36-3	PCBs, total	0.07	0.15	mg/kg-ww	LMB2F	5-18	0.05-0.05	0.15	N/A	0.0016 (C)	N/A		Yes	ASL
	72-54-8	DDD, p,p'-	0.01	0.03	mg/kg-ww	LMB2F, LMB4F	9-18	0.01-0.01	0.03	N/A	0.013 (C)	N/A		Yes	ASL
	72-55-9	DDE, p,p'-	0.01	0.07	mg/kg-ww	LMB2F	15-18	0.01-0.01	0.07	N/A	0.0093 (C)	N/A		Yes	ASL

Notes:

(1) Minimum/maximum concentration in data determined to be usable for risk assessment.

(2) Screening concentration = maximum detected concentration.

(3) Chemicals will not be screened out of or re-included in the risk assessment based on background concentrations or ARARs/TBCs.

(4) U.S. EPA Region III Risk-Based Concentrations (RBCs) for fish ingestion, April 7, 2005.

Value Type: C = carcinogenic (target risk = 1e-6).
N = noncarcinogenic (target HI = 0.1)

(5) Rationale Codes

Selection Reason: ASL = above screening level.
Deletion Reason: BSL = below screening level.
NUT = essential nutrient.
NSL = No Screening Levels

Additional Notes:

[a] RBC for hexavalent chromium.

[b] RBC for mercuric chloride.

Definitions:

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.

COPC = Chemical of Potential Concern.

N/A = not applicable.

ND = not determined.

TABLE 2-8

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

RAGS D TABLE 2

PLOW SHOP POND

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value (3)	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Near-shore Sediment	7429-90-5	Aluminum	1	27000	mg/kg	P-SED-3, PSPC14	135-135		27000	N/A	7600 (N)	N/A		**Yes**	ASL
	7440-36-0	Antimony	5	30.7	mg/kg	SHD-94-03X	7-71	1.09-500	30.7	N/A	3.1 (N)	N/A		**Yes**	ASL
	7440-38-2	Arsenic	0.11	6800	mg/kg	PSPC14	140-148	10-50	6800	N/A	0.39 (C)	N/A		**Yes**	ASL
	7440-39-3	Barium	0.27	370	mg/kg	PSPC14	125-137	5.18-15	370	N/A	537 (N)	N/A		No	BSL
	7440-41-7	Beryllium	0.4	5.41	mg/kg	SHD-92-03X Dup	27-124	0.078-50	5.41	N/A	15 (N)	N/A		No	BSL
	7440-43-9	Cadmium	0.792	66 (J2)	mg/kg	PSPC14	54-129	0.0044-150	66	N/A	3.7 (N)	N/A		**Yes**	ASL
	7440-70-2	Calcium	0.39	34000	mg/kg	PSPC13	133-135	1300-1300	34000	N/A	ND	N/A		No	NUT
	7440-47-3	Chromium, total	6.9	37800	mg/kg	SESHL02	135-148	0.0074-150	37800	N/A	22 (N) [a]	N/A		**Yes**	ASL
	7440-48-4	Cobalt	1.98	59	mg/kg	PSPC13	67-123	1.42-150	59	N/A	140 (N)	N/A		No	BSL
	7440-50-8	Copper	2.91	3450	mg/kg	RHD-94-02X	107-138	0.965-150	3450	N/A	310 (N)	N/A		**Yes**	ASL
	7439-89-6	Iron	2.5	410000	mg/kg	PSP06	135-135		410000	N/A	2300 (N)	N/A		**Yes**	ASL
	7439-92-1	Lead	0.956	1214.31	mg/kg	PS1	125-148	0.064-500	1214.31	N/A	400 (X)	N/A		**Yes**	ASL
	7439-95-4	Magnesium	13.6	8580	mg/kg	SHD-94-15X	126-135	100-100	8580	N/A	ND	N/A		No	NUT
	7439-96-5	Manganese	31	54800	mg/kg	SHD-92-02X	134-138	2.05-84	54800	N/A	180 (N)	N/A		**Yes**	ASL
	7439-97-6	Mercury	0.038	130	mg/kg	SESHL11	123-145	0.00018-0.05	130	N/A	2.3 (N)	N/A		**Yes**	ASL
	7440-02-0	Nickel	6.3	87.8	mg/kg	SHD-94-03X	91-138	1.71-300	87.8	N/A	160 (N)	N/A		No	BSL
	7440-09-7	Potassium	90.5	2340	mg/kg	SESHL08	54-134	100-50000	2340	N/A	ND	N/A		No	NUT
	7782-49-2	Selenium	0.496	19.2	mg/kg	SHD-92-20X	31-125	0.1-1000	19.2	N/A	39 (N)	N/A		No	BSL
	7440-22-4	Silver	0.589	2	mg/kg	PSEM-1, PSEM-2, PSEM-3	7-77	0.0061-150	2	N/A	39 (N)	N/A		No	BSL
	7440-23-5	Sodium	123	4280	mg/kg	SHD-94-14X	84-134	52-50000	4280	N/A	ND	N/A		No	NUT
	7440-28-0	Thallium	19.7	29.4	mg/kg	PSEM-1	3-56	18-1000	29.4	N/A	0.52 (N)	N/A		**Yes**	ASL
	7440-31-5	Tin	8.13	275	mg/kg	RHD-94-02X	3-4	4.9-4.9	275	N/A	4700 (N)	N/A		No	BSL
	7440-62-2	Vanadium	3.2	166	mg/kg	SESHL10	78-135	3.39-150	166	N/A	7.8 (N)	N/A		**Yes**	ASL
	7440-66-6	Zinc	9 (B)	1100	mg/kg	P-SED-9	94-138	8.03-150	1100	N/A	2300 (N)	N/A		No	BSL
	22967926	Mercury, methyl	0.0057	0.06538	mg/kg	PS1	8-8		0.06538	N/A	0.61 (N)	N/A		No	BSL
	83-32-9	Acenaphthene	0.0063 (J)	0.84	mg/kg	P-SED-9	7-11	0.0091-0.2	0.84	N/A	370 (N)	N/A		No	BSL
	208-96-8	Acenaphthylene	0.026	0.71	mg/kg	P-SED-9	7-7		0.71	N/A	370 (N) [b]	N/A		No	BSL
	120-12-7	Anthracene	0.038	3.4	mg/kg	P-SED-9	8-11	0.2-0.2	3.4	N/A	2200 (N)	N/A		No	BSL
	56-55-3	Benz(a)anthracene	0.09	7.1	mg/kg	P-SED-9	9-23	0.3-0.8	7.1	N/A	0.62 (C)	N/A		**Yes**	ASL
	50-32-8	Benzo(a)pyrene	0.12	6.5	mg/kg	P-SED-9	7-7		6.5	N/A	0.062 (C)	N/A		**Yes**	ASL
	205-99-2	Benzo(b)fluoranthene	0.12	11	mg/kg	P-SED-9	8-11	1-1	11	N/A	0.62 (C)	N/A		**Yes**	ASL
	191-24-2	Benzo(ghi)perylene	0.072	5.2	mg/kg	P-SED-9	7-7		5.2	N/A	230 (N) [c]	N/A		No	BSL
	207-08-9	Benzo(k)fluoranthene	0.071	3.7	mg/kg	P-SED-9	8-11	0.3-0.3	3.7	N/A	6.2 (C)	N/A		**Yes**	PAHc

TABLE 2-8

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

RAGS D TABLE 2

PLOW SHOP POND

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value (3)	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Near-shore Sediment	218-01-9	Chrysene	0.032	8.1	mg/kg	P-SED-9	9-23	0.45-0.6	8.1	N/A	62 (C)	N/A		**Yes**	PAHc
	53-70-3	Dibenz(ah)anthracene	0.028	1.3	mg/kg	P-SED-9	7-7		1.3	N/A	0.062 (C)	N/A		**Yes**	ASL
	206-44-0	Fluoranthene	0.013	18	mg/kg	P-SED-9	10-23	0.3-0.52	18	N/A	230 (N)	N/A		No	BSL
	86-73-7	Fluorene	0.025	1.9	mg/kg	P-SED-9	8-11	0.2-0.2	1.9	N/A	270 (N)	N/A		No	BSL
	193-39-5	Indeno(1,2,3-cd)pyrene	0.048	4.5	mg/kg	P-SED-9	7-7		4.5	N/A	0.62 (C)	N/A		**Yes**	ASL
	91-57-6	Methylnaphthalene, 2-	1	2	mg/kg	RHD-94-02X, RHD-94-03X, RHD-94-03X Dup	3-4	0.2-0.2	2	N/A	5.6 (N) [d]	N/A		No	BSL
	91-20-3	Naphthalene	0.024	2.4	mg/kg	P-SED-9	11-24	0.089-0.42	2.4	N/A	5.6 (N)	N/A		No	BSL
	85-01-8	Phenanthrene	0.13	10	mg/kg	P-SED-9	11-23	0.2-0.41	10	N/A	2200 (N) [e]	N/A		No	BSL
	129-00-0	Pyrene	0.24	14	mg/kg	P-SED-9	13-23	0.2-0.42	14	N/A	230 (N)	N/A		No	BSL
	53469-21-9	PCB 1242	0.11 (J)	0.11 (J)	mg/kg	P-SED-3	1-7	0.053-0.13	0.11	N/A	0.11 (N)	N/A		No	BSL
	11097-69-1	PCB 1254	0.13	0.13	mg/kg	P-SED-3	1-7	0.053-0.13	0.13	N/A	0.11 (N)	N/A		**Yes**	ASL
	11096-82-5	PCB 1260	0.05	0.05	mg/kg	P-SED-3	1-7	0.053-0.13	0.05	N/A	0.11 (N)	N/A		No	BSL
	72-54-8	DDD, p,p'-	0.013	1.8	mg/kg	SHD-92-02X	12-44	0.008-0.008	1.8	N/A	2.4 (C)	N/A		No	BSL
	72-55-9	DDE, p,p'-	0.028	1.3	mg/kg	SHD-92-02X	16-64	0.008-0.076	1.3	N/A	1.7 (C)	N/A		No	BSL
	50-29-3	DDT, p,p'-	0.0033 (J)	0.13	mg/kg	SHD-92-28X	8-52	0.0017-0.071	0.13	N/A	1.7 (C)	N/A		No	BSL
	76-44-8	Heptachlor	0.02	0.092	mg/kg	SESHL03	2-19	0.0017-0.012	0.092	N/A	0.11 (C)	N/A		No	BSL
	132-64-9	Dibenzofuran	0.4	0.8	mg/kg	RHD-94-03X, RHD-94-03X Dup	2-4	0.2-0.2	0.8	N/A	15 (N)	N/A		No	BSL
	67-64-1	Acetone	0.058	0.54	mg/kg	SESHL05	8-13	0.01-0.089	0.54	N/A	1400 (N)	N/A		No	BSL
	78-93-3	Methyl ethyl ketone	0.023	0.13	mg/kg	SESHL05, SESHL09	5-13	0.01-0.089	0.13	N/A	2200 (N)	N/A		No	BSL
	75-09-2	Methylene chloride	0.021	0.12	mg/kg	SESHL09	10-13	0.006-0.089	0.12	N/A	9.1 (C)	N/A		No	BSL
	75-69-4	Trichlorofluoromethane	0.008	0.008	mg/kg	SHD-92-30X	2-16	0.006-0.089	0.008	N/A	39 (N)	N/A		No	BSL

Notes:

(1) Minimum/maximum concentration in data determined to be useable for risk assessment.
Qualifiers: B = constituent present in associated blank
J = estimated
J2 = estimated

(2) Screening concentration = maximum detected concentration.

(3) Chemicals will not be screened out of or re-included in the risk assessment based on background concentrations or ARARs/TBCs.

(4) U.S. EPA Region IX Preliminary Remedial Goals (PRGs) for residential soil, December 28, 2004.
Value Type: C = carcinogenic (target risk = 1e-6).
N = noncarcinogenic (target HI = 0.1)
X = special health-based value not based on carcinogenic/noncarcinogenic endpoints.

Definitions: ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.
COPC = Chemical of Potential Concern.
N/A = not applicable.

TABLE 2-8

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

RAGS D TABLE 2

PLOW SHOP POND

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value (3)	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)

(5) Rationale Codes
Selection Reason: ASL = above screening level.
PAHc = carcinogenic PAH (although screening concentration < screening toxicity value, included as COPC due to the cumulative nature of carcinogenic PAHs).
Deletion Reason: BSL = below screening level.
NUT = essential nutrient.

Additional Notes:
[a] PRG for hexavalent chromium.
[b] PRG for acenaphthene used as a surrogate.
[c] PRG for pyrene used as a surrogate.
[d] PRG for naphthalene used as a surrogate.
[e] PRG for anthracene used as a surrogate.

TABLE 2-9

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

RAGS D TABLE 2

PLOW SHOP POND

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value (3)	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Surface Water	7429-90-5	Aluminum	0.008 (J)	0.035	mg/L	RED COVE	7-15	0.01-0.02	0.035	N/A	3.6 (N)	N/A		No	BSL
	7440-38-2	Arsenic	0.0014	0.38	mg/L	RED COVE	19-28	0.001-0.01	0.38	N/A	0.000045 (C)	N/A		**Yes**	ASL
	7440-39-3	Barium	0.00335	0.044	mg/L	RED COVE	28-28		0.044	N/A	0.26 (N)	N/A		No	BSL
	7440-70-2	Calcium	0.012	18.6	mg/L	PSEM-4	28-28		18.6	N/A	ND	N/A		No	NUT
	7440-47-3	Chromium, total	0.0008 (J)	0.001	mg/L	PS4-2004, PS5-2004, PS6-2004, RED COVE	7-28	0.002-0.00447	0.001	N/A	0.011 (N) [a]	N/A		No	BSL
	7440-48-4	Cobalt	0.00083	0.00083	mg/L	RCSW4	1-15	0.0002-0.0015	0.00083	N/A	0.073 (N)	N/A		No	BSL
	7440-50-8	Copper	0.001 (J)	0.0487	mg/L	SW-SHL-04	23-28	0.0015-0.00429	0.0487	N/A	0.15 (N)	N/A		No	BSL
	7439-89-6	Iron	0.214	29 (J2)	mg/L	RED COVE	28-28		29	N/A	1.1 (N)	N/A		**Yes**	ASL
	7439-92-1	Lead	0.0002 (J)	0.0004 (J)	mg/L	PS4-2004, PS6-2004	6-15	0.0002-0.005	0.0004	N/A	ND	N/A		**Yes**	NSL
	7439-95-4	Magnesium	0.0022	3.3	mg/L	PSEM-4	28-28		3.3	N/A	ND	N/A		No	NUT
	7439-96-5	Manganese	0.00781	0.53	mg/L	RED COVE	28-28		0.53	N/A	0.088 (N)	N/A		**Yes**	ASL
	7440-02-0	Nickel	0.0008	0.0442	mg/L	SW-SHL-04	18-28	0.006-0.00876	0.0442	N/A	0.073 (N)	N/A		No	BSL
	7440-09-7	Potassium	0.741	3	mg/L	PSEM-4	17-17		3	N/A	ND	N/A		No	NUT
	7440-22-4	Silver	0.000564	0.0036	mg/L	SW-SHL-09	2-28	0.0002-0.003	0.0036	N/A	99966693756E	N/A		No	BSL
	7440-23-5	Sodium	20	25.1	mg/L	PSEM-2	17-17		25.1	N/A	ND	N/A		No	NUT
	7440-66-6	Zinc	0.003 (J)	0.0581	mg/L	SW-SHL-04	14-28	0.008-0.02	0.0581	N/A	1.1 (N)	N/A		No	BSL
	319-84-6	Hexachlorocyclohexane, alpha-	0.000013	0.00007	mg/L	SW-SHL-04	13-19	0.0000275-0.0000275	0.00007	N/A	0.000011 (C)	N/A		**Yes**	ASL
	67-66-3	Chloroform	0.000996	0.00141	mg/L	SW-SHL-02	6-12	0.00083-0.00083	0.00141	N/A	0.00017 (C)	N/A		**Yes**	ASL
	75-09-2	Methylene chloride	0.00598	0.00892	mg/L	SW-SHL-12	12-12		0.00892	N/A	0.0043 (C)	N/A		**Yes**	ASL

Notes:
(1) Minimum/maximum concentration in data determined to be useable for risk assessment.
Qualifiers: J = estimated
(2) Screening concentration = maximum detected concentration.
(3) Chemicals will not be screened out of or re-included in the risk assessment based on background concentrations or ARARs/TBCs.
(4) U.S. EPA Region IX Preliminary Remedial Goals (PRGs) for tap water, December 28, 2004.
Value Type: C = carcinogenic (target risk = 1e-6).
N = noncarcinogenic (target HI = 0.1)
(5) Rationale Codes
Selection Reason: ASL = above screening level.
NSL = no screening level available.
Deletion Reason: BSL = below screening level.
NUT = essential nutrient.

Definitions:
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.
COPC = Chemical of Potential Concern.
N/A = not applicable.
ND = not determined.

Additional Notes:
[a] PRG for hexavalent chromium.

TABLE 2-10

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

RAGS D TABLE 2

PLOW SHOP POND

Scenario Timeframe: Current/Future
Medium: Fish
Exposure Medium: Fish (filet)

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value (3)	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Fish (filet)	7440-38-2	Arsenic	0.09	0.15	mg/kg-ww	PSP23F	2-10	0.04-0.16	0.15	N/A	0.0021 (C)	N/A		**Yes**	ASL
	7440-70-2	Calcium	82.8	627	mg/kg-ww	PSP18F2	10-10		627	N/A	ND	N/A		No	NUT
	7440-47-3	Chromium, total	0.19	0.24	mg/kg-ww	PSP06F	2-10	0.19-0.2	0.24	N/A	0.41 (N) [a]	N/A		No	BSL
	7440-48-4	Cobalt	0.11	0.11	mg/kg-ww	PSP18F2, PSP20F2	2-10	0.1-0.1	0.11	N/A	2.7 (N)	N/A		No	BSL
	7440-50-8	Copper	0.08	0.24	mg/kg-ww	PSP20F2	10-10		0.24	N/A	5.4 (N)	N/A		No	BSL
	7439-89-6	Iron	1.7	27	mg/kg-ww	PSP23F	10-10		27	N/A	41 (N)	N/A		No	BSL
	7439-95-4	Magnesium	252	344	mg/kg-ww	PSP17F	10-10		344	N/A	ND	N/A		No	NUT
	7439-96-5	Manganese	0.3	0.3	mg/kg-ww	PSP12F	1-10	0.28-0.3	0.3	N/A	2.7 (N)	N/A		No	BSL
	7439-97-6	Mercury	0.12	4	mg/kg-ww	PSP17F	9-10	0.03-0.03	4	N/A	0.041 (N) [b]	N/A		**Yes**	ASL
	7782-49-2	Selenium	0.11 (J)	0.2 (J)	mg/kg-ww	PSP17F2	8-10	0.1-0.18	0.2	N/A	0.68 (N)	N/A		No	BSL
	7440-23-5	Sodium	283	509	mg/kg-ww	PSP20F2	10-10		509	N/A	ND	N/A		No	NUT
	7440-62-2	Vanadium	0.79	0.79	mg/kg-ww	PSP17F	1-10	0.73-0.8	0.79	N/A	0.14 (N)	N/A		**Yes**	ASL
	7440-66-6	Zinc	3.4	6.1	mg/kg-ww	PSP22F	10-10		6.1	N/A	41 (N)	N/A		No	BSL
	72-55-9	DDE, p,p'-	0.015	0.031	mg/kg-ww	PSP17F2	2-10	0.0096-0.021	0.031	N/A	0.0093 (C)	N/A		**Yes**	ASL

Notes:

(1) Minimum/maximum concentration in data determined to be useable for risk assessment.
Qualifiers: J = estimated

(2) Screening concentration = maximum detected concentration.

(3) Chemicals will not be screened out of or re-included in the risk assessment based on background concentrations or ARARs/TBCs.

(4) U.S. EPA Region III Risk-Based Concentrations (RBCs) for fish ingestion, April 7, 2005.
Value Type: C = carcinogenic (target risk = 1e-6).
N = noncarcinogenic (target HI = 0.1)

(5) Rationale Codes
Selection Reason: ASL = above screening level.
Deletion Reason: BSL = below screening level.
NUT = essential nutrient.

Definitions:
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.
COPC = Chemical of Potential Concern.
N/A = not applicable.
ND = not determined.

Additional Notes:

[a] RBC for hexavalent chromium.

[b] RBC for mercuric chloride.

TABLE 3-1

EXPOSURE POINT CONCENTRATION SUMMARY

RAGS D TABLE 3

REASONABLE MAXIMUM EXPOSURE

GROVE POND

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Near-shore Sediment

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Near-shore sediment	Aluminum	mg/kg	11800	20300 (NP)	90000	20300	mg/kg	C97.5	UCL < max
	Antimony	mg/kg	5.45	11.9 (NP)	49.2	11.9	mg/kg	C97.5	UCL < max
	Arsenic	mg/kg	81.0	158 (NP)	1300	158	mg/kg	C97.5	UCL < max
	Cadmium	mg/kg	13.1	48.6 (NP)	730	48.6	mg/kg	C97.5	UCL < max
	Chromium, total	mg/kg	5070	144 (NP)	52000	144	mg/kg	C99	UCL < max
	Copper	mg/kg	153	795 (NP)	13000	795	mg/kg	C97.5	UCL < max
	Iron	mg/kg	13900	19100 (NP)	42800	19100	mg/kg	C97.5	UCL < max
	Lead	mg/kg	227	382 (LN)	1760	227	mg/kg	mean	models specify mean
	Manganese	mg/kg	477	721 (NP)	2500	721	mg/kg	C97.5	UCL < max
	Mercury	mg/kg	24.8	94.4 (NP)	422	94.4	mg/kg	C99	UCL < max
	Selenium	mg/kg	4.86	9.76 (NP)	41.2	9.76	mg/kg	C97.5	UCL < max
	Thallium	mg/kg	8.87	26.4 (NP)	82.4	26.4	mg/kg	C99	UCL < max
	Vanadium	mg/kg	26.8	42.7 (NP)	140	42.7	mg/kg	C97.5	UCL < max
	Benz(a)anthracene	mg/kg	0.401	0.684 (NP)	3.4	0.684	mg/kg	C95	UCL < max
	Benzo(a)pyrene	mg/kg	0.420	0.729 (NP)	2.3	0.729	mg/kg	C95	UCL < max
	Benzo(b)fluoranthene	mg/kg	0.462	0.850 (NP)	5	0.850	mg/kg	C95	UCL < max
	Benzo(k)fluoranthene	mg/kg	0.361	0.839 (NP)	4.9	0.839	mg/kg	C97.5	UCL < max
	Chrysene	mg/kg	0.499	1.10 (NP)	5	1.10	mg/kg	C97.5	UCL < max
	Dibenz(ah)anthracene	mg/kg	0.242	0.263 (N)	0.73	0.263	mg/kg	St	UCL < max
	Indeno(1,2,3-cd)pyrene	mg/kg	0.384	0.641 (NP)	2.9	0.641	mg/kg	C95	UCL < max
	Naphthalene	mg/kg	1.10	3.84 (NP)	30	3.84	mg/kg	C97.5	UCL < max
	DDD, p,p'-	mg/kg	0.147	0.381 (NP)	2.5 (C)	0.381	mg/kg	C97.5	UCL < max

TABLE 3-1

EXPOSURE POINT CONCENTRATION SUMMARY

RAGS D TABLE 3

REASONABLE MAXIMUM EXPOSURE

GROVE POND

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Near-shore Sediment

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale

Notes:
(1) 95-percent upper confidence limit on the mean concentration (USEPA, ProUCL, 2004).
Distribution: LN = lognormal.
N = normal.
NP = non-parametric.
(2) Data statistic used to represent the exposure point concentration.
C95 = 95% Chebyshev (Mean, StdDev) UCL.
C97.5 = 97.5% Chebyshev (Mean, StdDev) UCL.
C99 = 99% Chebyshev (Mean, StdDev) UCL.
H95 = 95% H-UCL.
St = Student's-t UCL.

TABLE 3-2

EXPOSURE POINT CONCENTRATION SUMMARY

RAGS D TABLE 3

REASONABLE MAXIMUM EXPOSURE

GROVE POND

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Surface Water	Arsenic	mg/L	0.0143	0.0767 (NP)	0.128	0.0767	mg/L	C99	UCL < max
	Barium	mg/L	1.21	6.99 (NP)	11.9	6.99	mg/L	C99	UCL < max
	Chromium, total	mg/L	0.0131	0.0740 (NP)	0.175	0.0740	mg/L	C99	UCL < max
	Iron	mg/L	39.2	69.2 (NP)	390	69.2	mg/L	HB	UCL < max
	Lead	mg/L	0.00275	0.0117 (NP)	0.027	0.00275	mg/L	mean	models specify mean
	Manganese	mg/L	15.7	112 (NP)	268	112	mg/L	C99	UCL < max
	Zinc	mg/L	1.65	7.19 (NP)	9.11	7.19	mg/L	C99	UCL < max
	Bis(2-ethylhexyl) phthalate	mg/L	0.0153	0.0350 (NP)	0.051	0.0350	mg/L	C95	UCL < max

Notes:

(1) 95-percent upper confidence limit on the mean concentration (USEPA, ProUCL, 2004).

Distribution: N = normal.
NP = non-parametric.

(2) Data statistic used to represent the exposure point concentration.

C95 = 95% Chebyshev (Mean, StdDev) UCL.
C99 = 99% Chebyshev (Mean, StdDev) UCL.
HB = Hall's bootstrap UCL.
max = maximum detected concentration.
St = Student's-t UCL.

TABLE 3-3

EXPOSURE POINT CONCENTRATION SUMMARY

RAGS D TABLE 3

REASONABLE MAXIMUM EXPOSURE

GROVE POND

Scenario Timeframe: Current/Future
Medium: Fish
Exposure Medium: Fish (filet)

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Fish (filet)	Cadmium	mg/kg	0.0282	0.0736 (NP)	0.151	0.0736	mg/kg	C95	UCL < max
	Chromium	mg/kg	0.227	0.278 (G)	0.488	0.278	mg/kg	Gap	UCL < max
	Lead	mg/kg	0.200	0.815 (NP)	0.859	0.200	mg/kg	mean	models specify mean
	Mercury	mg/kg	0.307	0.497 (G)	1.04	0.497	mg/kg	Gap	UCL < max
	Vanadium	mg/kg	0.0583	0.0715 (N)	0.164	0.0715	mg/kg	St	UCL < max
	PCBs, total	mg/kg	0.0464	0.0860 (NP)	0.15	0.0860	mg/kg	C95	UCL < max
	DDD, p,p'-	mg/kg	0.0114	0.0203 (NP)	0.03	0.0203	mg/kg	C95	UCL < max
	DDE, p,p'-	mg/kg	0.0214	0.0424 (NP)	0.07	0.0424	mg/kg	C95	UCL < max

Notes:

(1) 95-percent upper confidence limit on the mean concentration (USEPA, ProUCL, 2004).

Distribution: G = gamma.
N = normal.
NP = non-parametric.

(2) Data statistic used to represent the exposure point concentration.

C95 = 95% Chebyshev (Mean, StdDev) UCL.
C99 = 99% Chebyshev (Mean, StdDev) UCL.
Gap = approximate gamma UCL.
St = Student's-t UCL.

TABLE 3-4

EXPOSURE POINT CONCENTRATION SUMMARY

RAGS D TABLE 3

REASONABLE MAXIMUM EXPOSURE

PLOW SHOP POND

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Near-shore Sediment

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Near-shore sediment	Aluminum	mg/kg	6810	9660 (NP)	27000	9660	mg/kg	C97.5	UCL < max
	Antimony	mg/kg	9.85	17.1 (NP)	30.7	17.1	mg/kg	C97.5	UCL < max
	Arsenic	mg/kg	435	930 (NP)	6800	930	mg/kg	C97.5	UCL < max
	Cadmium	mg/kg	8.28	15.3 (NP)	66 (J2)	15.3	mg/kg	C97.5	UCL < max
	Chromium, total	mg/kg	1360	12200 (LN)	37800	12200	mg/kg	H95	UCL < max
	Copper	mg/kg	97.5	297 (NP)	3450	297	mg/kg	C97.5	UCL < max
	Iron	mg/kg	47500	96300 (NP)	410000	96300	mg/kg	C97.5	UCL < max
	Lead	mg/kg	124	229 (NP)	1210	124	mg/kg	mean	models specify mean
	Manganese	mg/kg	1980	3020 (LN)	54800	3020	mg/kg	H95	UCL < max
	Mercury	mg/kg	13.8	34.7 (NP)	130	34.7	mg/kg	C99	UCL < max
	Thallium	mg/kg	11.9	13.4 (NP)	29.4	13.4	mg/kg	Mod-t	UCL < max
	Vanadium	mg/kg	20.9	35.6 (NP)	166	35.6	mg/kg	C97.5	UCL < max
	Benz(a)anthracene	mg/kg	0.647	3.65 (NP)	7.1	3.65	mg/kg	C99	UCL < max
	Benzo(a)pyrene	mg/kg	1.37	4.67 (G)	6.5	4.67	mg/kg	GAp	UCL < max
	Benzo(b)fluoranthene	mg/kg	1.76	3.90 (G)	11	3.90	mg/kg	GAp	UCL < max
	Benzo(k)fluoranthene	mg/kg	0.18	1.44 (G)	3.7	1.44	mg/kg	GAp	UCL < max
	Chrysene	mg/kg	0.812	4.28 (NP)	8.1	4.28	mg/kg	C99	UCL < max
	Dibenz(ah)anthracene	mg/kg	0.326	0.960 (G)	1.3	0.960	mg/kg	GAp	UCL < max
	Indeno(1,2,3-cd)pyrene	mg/kg	1.04	3.66 (G)	4.5	3.66	mg/kg	GAp	UCL < max

Notes:
(1) 95-percent upper confidence limit on the mean concentration (USEPA, ProUCL, 2004).
Distribution: G = gamma.
LN = lognormal.

TABLE 3-4

EXPOSURE POINT CONCENTRATION SUMMARY

RAGS D TABLE 3

REASONABLE MAXIMUM EXPOSURE

PLOW SHOP POND

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Near-shore Sediment

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale

NP = non-parametric.

TABLE 3-4

EXPOSURE POINT CONCENTRATION SUMMARY

RAGS D TABLE 3

REASONABLE MAXIMUM EXPOSURE

PLOW SHOP POND

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Near-shore Sediment

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale

(2) Data statistic used to represent the exposure point concentration.

C97.5 = 97.5% Chebyshev (Mean, StdDev) UCL.

C99 = 99% Chebyshev (Mean, StdDev) UCL.

GAp = approximate gamma UCL.

H95 = 95% H-UCL.

Mod-t = modified Student's-t (adjusted for skewness)

TABLE 3-5

EXPOSURE POINT CONCENTRATION SUMMARY

RAGS D TABLE 3

REASONABLE MAXIMUM EXPOSURE

PLOW SHOP POND

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Surface Water	Arsenic	mg/L	0.0175	0.151 (NP)	0.38	0.151	mg/L	C99	UCL < max
	Iron	mg/L	1.52	5.97 (NP)	29 (J2)	5.97	mg/L	C95	UCL < max
	Lead	mg/L	0.000322	0.00379 (NP)	0.0004 (J)	0.000322	mg/L	mean	models specify mean
	Manganese	mg/L	0.0862	0.148 (LN)	0.53	0.148	mg/L	H95	UCL < max
	Hexachlorocyclohexane, alpha-	mg/L	0.0000331	0.0000524 (NP)	0.00007	0.0000524	mg/L	C95	UCL < max
	Chloroform	mg/L	0.000795	0.00131 (NP)	0.00141	0.00131	mg/L	C95	UCL < max
	Methylene chloride	mg/L	0.00766	0.00804 (N)	0.00892	0.00804	mg/L	St	UCL < max

Notes:

(1) 95-percent upper confidence limit on the mean concentration (USEPA, ProUCL, 2004).

Distribution: LN = lognormal.
N = normal.
NP = non-parametric.

(2) Data statistic used to represent the exposure point concentration.

C95 = 95% Chebyshev (Mean, StdDev) UCL.
C99 = 99% Chebyshev (Mean, StdDev) UCL.
H95 = 95% H-UCL.
St = Student's-t UCL.

TABLE 3-6

EXPOSURE POINT CONCENTRATION SUMMARY

RAGS D TABLE 3

REASONABLE MAXIMUM EXPOSURE

PLOW SHOP POND

Scenario Timeframe: Current/Future
Medium: Fish
Exposure Medium: Fish (filet)

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Fish (filet)	Arsenic	mg/kg	0.0498	0.0796 (G)	0.15	0.0796	mg/kg	Gap	UCL < max
	Mercury	mg/kg	1.14	2.59 (G)	4	2.59	mg/kg	Gap	UCL < max
	Vanadium	mg/kg	0.408	0.449 (NP)	0.79	0.449	mg/kg	Mt	UCL < max
	DDE, p,p'-	mg/kg	0.00967	0.0187 (NP)	0.031	0.0187	mg/kg	C95	UCL < max

Notes:
(1) 95-percent upper confidence limit on the mean concentration (USEPA, ProUCL, 2004).
Distribution: G = gamma.
NP = non-parametric.
(2) Data statistic used to represent the exposure point concentration.
C95 = 95% Chebyshev (Mean, StdDev) UCL.
Gap = approximate gamma UCL.
Mt = Mod-t UCL (adjusted for skewness).

TABLE 3-7

VALUES USED FOR DAILY INTAKE CALCULATIONS

RAGS D TABLE 4

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Sediment
Receptor Population: Recreational
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CSD	Chemical concentration in sediment	mg/kg	EPC	Site Specific	CDI (mg/kg-day) =
	IR	Ingestion rate	mg/day	100	EPA, 1995 (same as soil)	(CSD x IR x FI x EF x ED x CF)/(BW x AT)
	FI	Fraction ingested	unitless	100%	Professional Judgment	
	EF	Exposure Frequency	days/year	65	3 days/week for May-Sept	
	ED	Exposure Duration	years	30	Residential recreational adult	
	CF	Conversion factor	kg/mg	1.00E-06	- -	
	BW	Body weight	kg	70	EPA, 1991	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging time (Noncancer)	days	10,950	EPA, 1989	
	DAD	Dermally absorbed dose	mg/kg-day	Calculated	EPA 2004	
Dermal	DA_{event}	Absorbed dose per enent	mg/cm^2-event	Calculated	EPA 2004	DAD (mg/kg-day) =
	EF	Exposure Frequency	days/year	65	3 days/week for May-Sept	(DA_{event} x EF x ED x EV x SA)/(BW x AT)
	ED	Exposure Duration	years	30	Residential recreational adult	
	EV	Event Frequency	events/day	1	Professional Judgment	where
	SA	Surface Area	cm^2	4,500	EPA 1997, 2004 (25% of total area)	DA_{event} (mg/cm^2-event) =
	BW	Body weight	kg	70	EPA, 1991	CSD x CF x AF x ABS_d
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging time (Noncancer)	days	10,950	EPA, 1989	
	CSD	Chemical concentration in sediment	mg/kg	EPC	Site Specific	
	CF	Conversion factor	kg/mg	1.00E-06	- -	
	AF	Soil-Skin Adherence factor	mg/cm^2-event	1	MADEP (2002-B - sediment)	
	ABS_d	Dermal Absorption fraction	unitless	chemical specific	EPA 2004	

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1995: Supplemental Guidance to RAGS: Region IV Bulletins, Human Health Risk Assessment, EPA Region 4, Atlanta, GA, November 1995

EPA, 1997: EPA Exposure Factors Handbook, 1997.

EPA, 2004: Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final

MADEP 2002-B: Technical Update, Weighted Skin-Soil Adherence Factors.

TABLE 3-8

VALUES USED FOR DAILY INTAKE CALCULATIONS

RAGS D TABLE 4

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water
Receptor Population: Recreational
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name
Ingestion	C_{SW}	Chemical concentration in surface water	mg/L	EPC	Site Specific	CDI (mg/kg-day) =
	IR	Ingestion rate - wading	l/hour	0.01	EPA, 1995 (10ml/hr)	(CSW x IR x ET x EF x ED)/(BW x AT)
	ET	Exposure time	hours/day	4	Professional Judgment	
	EF	Exposure frequency	days/year	65	Professional Judgment--3 days/week for May-Sept	
	ED	Exposure duration	years	30	Residential recreational adult	
	BW	Body weight	kg	70	EPA, 1991	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging time (Noncancer)	days	10,950	EPA, 1989	
	DAD	Dermally absorbed dose	mg/kg-day	Calculated	EPA 2004	
Dermal	DA_{event}	Absorbed dose per unit body surface/day	mg/cm^2-event	Calculated	EPA 2004	DAD (mg/kg-day) =
	EV	Event Frequency	events/day	1	Professional Judgment	(DA_{event} x EV x ED x EF x SA)/(BW x AT)
	ED	Exposure duration	years	30	Residential recreational adult	
	EF	Exposure frequency	days/year	65	Professional Judgment--3 days/week for May-Sept	
	SA	Surface area	cm^2	4,500	EPA 1997, 2004 (25% of total area)	For organics:
	BW	Body weight	kg	70	EPA, 1991	if t_{event} is less than or equal to t* then:
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	DA_{event} (mg/cm^2-event) =
	AT-N	Averaging time (Noncancer)	days	5,110	EPA, 1989	2 x FA x Kp x C_{SW} x CF x (SQRT(6 x tau_{event} x t_{event}/PI))
	FA	Fraction absorbed water	unitless	1	EPA 2004 (assume no desquamation)	if t_{event} is greater than t* then:
	Kp	Permeability coefficient	cm/hour	Chemical specific	- -	
	C_{SW}	Chemical concentration in surface water	mg/L	EPC	Site Specific	
	CF	Conversion factor	L/cm^3	0.001	Converts L to cm^3	
	tau_{event}	lag time per event	hours/event	Chemical specific	- -	For inorganics:
	t_{event}	Event Duration	hours/event	4	Professional Judgment	DA_{event} (mg/cm^2-event) =
	PI	Value of Pi	unitless	3.14	- -	Kp x C_{SW} x CF x t_{event}
	t*	Time to reach steady-state (hr) = 2.4 x tau_{event}	hours/event	Chemical specific	- -	

VALUES USED FOR DAILY INTAKE CALCULATIONS

RAGS D TABLE 4

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water
Receptor Population: Recreational
Receptor Age: Adult

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1995: Supplemental Guidance to RAGS: Region IV Bulletins, Human Health Risk Assessment, EPA Region 4, Atlanta, GA, November 1995 http://www.epa.gov/region4/waste/ots/healtbul.htm

EPA, 1997: EPA Exposure Factors Handbook, 1997.

EPA, 2004: Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final

TABLE 3-9

VALUES USED FOR DAILY INTAKE CALCULATIONS

RAGS D TABLE 4

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Fish
Exposure Medium: Fish
Exposure Point: Fish
Receptor Population: Recreational
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS_{fish}	Chemical concentration in fish tissue	mg/kg	EPC	Site Specific	CDI (mg/kg-day) =
	IR_{fish}	Fish ingestion rate	g/meal-day	227	EPA, 2000 (8 oz portion for and adult)	$(CS_{fish}$ x IR x FI x EF x ED x CF)/(BW x AT)
	FI	Fraction ingested	unitless	1	Professional Judgment	
	EF	Exposure Frequency	meal-days/year	41	1.05 meal/week (EPA, 1997-Table 10-63/ 90th percentile) for 9 temperate months of the year (39 weeks)	
	ED	Exposure Duration	years	30	Residential recreational adult	
	CF	Conversion factor	kg/g	1.00E-03	- -	
	BW	Body weight	kg	70	EPA, 1991	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging time (Noncancer)	days	10,950	EPA, 1989 (ED * 365)	

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1997: EPA Exposure Factors Handbook, 1997.

EPA, 2000: Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume II Risk Assessment and Fish Consupmption Limits, Third Edition.

TABLE 3-10

VALUES USED FOR DAILY INTAKE CALCULATIONS

RAGS D TABLE 4

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Sediment
Receptor Population: Recreational User
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CSD	Chemical concentration in sediment	mg/kg	EPC	Site Specific	CDI (mg/kg-day) =
	IR	Ingestion rate	mg/day	200	EPA, 1995 (same as soil)	(CSD x IR x FI x EF x ED x CF)/(BW x AT)
	FI	Fraction ingested	unitless	100%	Professional Judgment	
	EF	Exposure Frequency	days/year	65	3 days/week for May-Sept	
	ED	Exposure Duration	years	6	Used EPA 1991 value for residential child	
	CF	Conversion factor	kg/mg	1.00E-06	- -	
	BW	Body weight	kg	15	EPA, 1991	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging time (Noncancer)	days	2,190	EPA, 1989	
	DAD	Dermally absorbed dose	mg/kg-day	Calculated	EPA 2004	
Dermal	DA_{event}	Absorbed dose per enent	mg/cm^2-event	Calculated	EPA 2004	DAD (mg/kg-day) =
	EF	Exposure Frequency	days/year	65	3 days/week for May-Sept	(DA_{event} x EF x ED x EV x SA)/(BW x AT)
	ED	Exposure Duration	years	6	Used EPA 1991 value for residential child	
	EV	Event Frequency	events/day	1	Professional Judgment	where
	SA	Surface Area	cm^2	1,650	25% of the average (male and female) of 50^{th} percentile total body surface areas for age = 0 to 6 years (USEPA, 2004).	DA_{event} (mg/cm^2-event) =
	BW	Body weight	kg	15	EPA, 1991	CSD x CF x AF x ABS_d
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging time (Noncancer)	days	2,190	EPA, 1989	
	CSD	Chemical concentration in sediment	mg/kg	EPC	Site Specific	
	CF	Conversion factor	kg/mg	1.00E-06	- -	
	AF	Soil-Skin Adherence factor	mg/cm^2-event	1	MADEP (2002-B - sediment)	
	ABS_d	Dermal Absorption fraction	unitless	chemical specific	EPA 2004	

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1995: Supplemental Guidance to RAGS: Region IV Bulletins, Human Health Risk Assessment, EPA Region 4, Atlanta, GA, November 1995

EPA, 1997: EPA Exposure Factors Handbook, 1997.

EPA, 2004: Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final

MADEP 2002-B: Technical Update, Weighted Skin-Soil Adherence Factors.

TABLE 3-11
VALUES USED FOR DAILY INTAKE CALCULATIONS
RAGS D TABLE 4
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water
Receptor Population: Recreational User
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CSW	Chemical concentration in surface water	mg/L	EPC	Site Specific	CDI (mg/kg-day) =
	IR	Ingestion rate - wading	l/hour	0.05	EPA, 1995 (50ml/hr)	(CSW x IR x ET x EF x ED)/(BW x AT)
	ET	Exposure Time	hours/day	4	Professional Judgment	
	EF	Exposure Frequency	days/year	65	Professional Judgment--3 days/week for May-Sept	
	ED	Exposure Duration	years	6	EPA, 1991	
	BW	Body weight	kg	15	EPA, 1991	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging time (Noncancer)	days	2,190	EPA, 1989	
	DAD	Dermally absorbed dose	mg/kg-day	Calculated	EPA 2004	
Dermal	DA_{event}	Absorbed dose per unit body surface/day	mg/cm^2-event	Calculated	EPA 2004	DAD (mg/kg-day) =
	EV	Event Frequency	events/day	1	Professional Judgment	(DA_{event} x EV x ED x EF x SA)/(BW x AT)
	ED	Exposure duration	years	6	Recreational child	
	EF	Exposure frequency	days/year	65	Professional Judgment--3 days/week for May-Sept	
	SA	Surface area	cm^2	1,650	EPA 1997, 2004 (25% of total area)	For organics:
	BW	Body weight	kg	15	EPA, 1991	if t_{event} is less than or equal to t* then:
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	DA_{event} (mg/cm^2-event) =
	AT-N	Averaging time (Noncancer)	days	2,190	EPA, 1989	2 x FA x Kp x C_{SW} x CF x (SQRT(6 x tau_{event} x t_{event}/PI))
	FA	Fraction absorbed water	unitless	1	EPA 2004 (assume no desquamation)	
	Kp	Permeability coefficient	cm/hour	Chemical specific	- -	
	C_{SW}	Chemical concentration in surface water	mg/L	EPC	Site Specific	
	CF	Conversion factor	L/cm^3	0.001	Converts L to cm^3	
	tau_{event}	lag time per event	hours/event	Chemical specific	- -	For inorganics:
	t_{event}	Event Duration	hours/event	4	Professional Judgment	DA_{event} (mg/cm^2-event) =
	PI	Value of Pi	unitless	3.14	- -	Kp x C_{SW} x CF x t_{event}
	t*	Time to reach steady-state (hr) = 2.4 x tau_{event}	hours/event	Chemical specific	- -	

TABLE 3-11
VALUES USED FOR DAILY INTAKE CALCULATIONS
RAGS D TABLE 4
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water
Receptor Population: Recreational User
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1995: Supplemental Guidance to RAGS: Region IV Bulletins, Human Health Risk Assessment, EPA Region 4, Atlanta, GA, November 1995 http://www.epa.gov/region4/waste/ots/healtbul.htm

EPA, 1997: EPA Exposure Factors Handbook, 1997.

EPA, 2004: Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final

TABLE 3-12

VALUES USED FOR DAILY INTAKE CALCULATIONS

RAGS D TABLE 4

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Fish
Exposure Medium: Fish
Exposure Point: Fish
Receptor Population: Recreational
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS_{fish}	Chemical concentration in fish tissue	mg/kg	EPC	Site Specific	CDI (mg/kg-day) =
	IR_{fish}	Fish ingestion rate	g/meal-day	85	EPA, 2000 (3 oz portion for a child)	(CS_{fish} x IR x FI x EF x ED x CF)/(BW x AT)
	FI	Fraction ingested	unitless	1	Professional Judgment	
	EF	Exposure Frequency	meal-days/year	41	1.05 meal/week (EPA, 1997-Table 10-63/ 90th percentile) for 9 temperate months of the year (39 weeks)	
	ED	Exposure Duration	years	6	Residential recreational child	
	CF	Conversion factor	kg/g	1.00E-03	- -	
	BW	Body weight	kg	15	EPA, 1991	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging time (Noncancer)	days	2,190	EPA, 1989	

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1997: EPA Exposure Factors Handbook, 1997.

EPA, 2000: Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume II Risk Assessment and Fish Consupmption Limits, Third Edition.

TABLE 3-13

VALUES USED FOR DAILY INTAKE CALCULATIONS

RAGS D TABLE 4

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Fish
Exposure Medium: Fish
Exposure Point: Fish
Receptor Population: Subsistence
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS_{fish}	Chemical concentration in fish tissue	mg/kg	EPC	Site Specific	CDI (mg/kg-day) =
	IR_{fish}	Fish ingestion rate	g/meal-day	227	EPA, 2000 (8 oz portion for and adult)	(CS_{fish} x IR x FI x EF x ED x CF)/(BW x AT)
	FI	Fraction ingested	unitless	1	Professional Judgment	
	EF	Exposure Frequency	meal-days/year	273	Assumed 7 meals/week for 9 temperate months of the year (39 weeks)	
	ED	Exposure Duration	years	30	EPA 1991 for Residential adult	
	CF	Conversion factor	kg/g	1.00E-03	- -	
	BW	Body weight	kg	70	EPA, 1991	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging time (Noncancer)	days	10,950	EPA, 1989	

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1997: EPA Exposure Factors Handbook, 1997.

EPA, 2000: Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume II Risk Assessment and Fish Consupmption Limits, Third Edition.

TABLE 3-14

VALUES USED FOR DAILY INTAKE CALCULATIONS

RAGS D TABLE 4

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Fish
Exposure Medium: Fish
Exposure Point: Fish
Receptor Population: Subsistence
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS_{fish}	Chemical concentration in fish tissue	mg/kg	EPC	Site Specific	CDI (mg/kg-day) =
	IR_{fish}	Fish ingestion rate	g/meal-day	85	EPA, 2000 (3 oz portion for a childt)	(CS_{fish} x IR x FI x EF x ED x CF)/(BW x AT)
	FI	Fraction ingested	unitless	1	Professional Judgment	
	EF	Exposure Frequency	meal-days/year	273	Assumed 7 meals/week for 9 temperate months of the year (39 weeks)	
	ED	Exposure Duration	years	6	EPA 1991 for Residential child	
	CF	Conversion factor	kg/g	1.00E-03	- -	
	BW	Body weight	kg	15	EPA, 1991	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	
	AT-N	Averaging time (Noncancer)	days	10,950	EPA, 1989	

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1996: EPA Soil Screening Guidance: Technical Background Document, May 1996.

EPA, 2000: Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume II Risk Assessment and Fish Consupmption Limits, Third Edition.

TABLE 3-15
DERMAL ABSORPTION FRACTION FROM SOIL
GROVE POND/PLOW SHOP POND

Compound	Dermal Absorption Fraction (ABS_d)	Notes
Aluminum	NQ- Addressed as an uncertainty	
Antimony	NQ- Addressed as an uncertainty	
Arsenic	0.03	
Barium	NQ- Addressed as an uncertainty	
Cadmium (in solid media)	0.001	
Cadmium (in water)	NA	
Chromium, total	NQ- Addressed as an uncertainty	
Copper	NQ- Addressed as an uncertainty	
Iron	NQ- Addressed as an uncertainty	
Lead	NQ- Addressed as an uncertainty	
Manganese (in sediment or water)	NQ- Addressed as an uncertainty	
Manganese (in food)	NQ- Addressed as an uncertainty	
Mercury	NQ- Addressed as an uncertainty	
Selenium	NQ- Addressed as an uncertainty	
Thallium	NQ- Addressed as an uncertainty	
Vanadium	NQ- Addressed as an uncertainty	
Zinc	NQ- Addressed as an uncertainty	
Chloroform	NQ- Addressed as an uncertainty	
Hexachlorocyclohexane, alpha-	0.04	
Methylene chloride	NQ- Addressed as an uncertainty	
Benz(a)anthracene	0.13	
Benzo(a)pyrene	0.13	
Benzo(b)fluoranthene	0.13	
Benzo(k)fluoranthene	0.13	
Chrysene	0.13	
Dibenz(ah)anthracene	0.13	
Indeno(1,2,3-cd)pyrene	0.13	
Naphthalene	0.13	
Bis(2-ethylhexyl) phthalate	0.1	
PCB 1254	0.14	
PCBs, total	0.14	a
DDD, p,p'-	0.03	a
DDE, p,p'-	0.03	

Note:
(1) Source: EPA 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final

(a) Surrogate value from DDT

TABLE 3-16
Dermal Worksheet
Intermediate Variables for Calculating DA(event)
GROVE POND/PLOW SHOP POND

Calculation of DA event for Surface Water

Dermal	DA_{event}	Absorbed dose per unit body surface/day	mg/cm^2-event	Calculated	EPA 2004
	FA	Fraction absorbed water	unitless	1	EPA 2004 (assume no desquamation)
	Kp	Permeability coefficient	cm/hour	Chemical specific	- -
	C_{SW}	Chemical concentration in surface water	mg/L	EPC	Site Specific
	CF	Conversion factor	L/cm^3	0.001	Converts L to cm^3
	tau_{event}	lag time per event	hours/event	Chemical specific	- -
	t_{event}	Event Duration	hours/event	4	Professional Judgment
	PI	Value of Pi	unitless	3.14	- -
	t*	Time to reach steady-state (hr) = 2.4 x tau_{event}	hours/event	Chemical specific	- -

DA event for Organics

where t_{event} is less than or equal to t* then:

Equation 1

DA_{event} (mg/cm^2-event) =

2 x FA x Kp x C_{SW} x CF x (SQRT(6 x tau_{event} x t_{event}/PI))

where t_{event} is greater than t* then:

Equation 2

$$If\ t_{event} > t^*,\ then:\ DA_{event} = FA \times K_p \times C_w \left[\frac{t_{event}}{1+B} + 2\ \tau_{event}\left(\frac{1+3\ B+3\ B^2}{(1+B)^2}\right)\right] \quad \text{x CF}$$

Organic COPCs in Surface water	t_{event}	t*	t*>t event	Equation to Use for DA event	DA event	Chem Specific Factor1	FA	Chem Specific Kp	Chem Specific Csw	CF	Factor2	tau_{event}	t_{event}	PI	B
Grove Pond															
Bis(2-ethylhexyl) phthalate	4	39.93	Yes	Equation 1	**1.97E-05**	2	1	2.50E-02	0.0350	0.001	6	16.64	4	3.142	0.2
Plow Shop Pond															
Hexachlorocyclohexane, alpha-	4	10.97	Yes	Equation 1	**6.81E-09**	2	1	1.10E-02	0.0000524	0.001	6	4.57	4	3.142	0.1
Chloroform	4	1.19	No	Equation 2	**4.45E-08**	2	1	6.80E-03	0.00131	0.001	6	0.5	4	3.142	0
Methylene chloride	4	0.76	No	Equation 2	**1.31E-07**	2	1	3.50E-03	0.00804	0.001	6	0.32	4	3.142	0

TABLE 3-16
Dermal Worksheet
Intermediate Variables for Calculating DA(event)
GROVE POND/PLOW SHOP POND

Calculation of DA event for Surface Water

DA event for Inorganics

DA_{event} (mg/cm^2-event) =

Kp x C_{SW} x CF x t_{event}

Inrganic COPCs in Surface water	t_{event}				DA event		Source of Kp	Chem Specific Kp	Chem Specific Csw	CF
Grove Pond										
Arsenic	4				**3.07E-07**		default	0.001	0.0767	0.001
Barium	4				**2.80E-05**		default	0.001	6.99	0.001
Chromium, total	4				**5.92E-07**		experimental	0.002	0.0740	0.001
Iron	4				**2.77E-04**		default	0.001	69.2	0.001
Lead	4				**4.68E-08**		default	0.001	0.0117	0.001
Manganese	4				**4.48E-04**		default	0.001	112	0.001
Zinc	4				**1.73E-05**		experimental	6.00E-04	7.19	0.001
Plow Shop Pond										
Arsenic	4				**6.04E-07**		default	0.001	0.151	0.001
Iron	4				**2.39E-05**		default	0.001	5.97	0.001
Lead	4				**1.52E-09**		default	0.001	0.000379	0.001
Manganese	4				**5.92E-07**		default	0.001	0.148	0.001

TABLE 4-1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

RAGS D TABLE 5

GROVE POND / PLOW SHOP POND

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (ABS_{GI}) (1)	Absorbed RfD for Dermal (2)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s)
Aluminum	Chronic	1.00E+00	mg/kg/day	1.00	1.00E+00	mg/kg-day	Central nervous system	100	PPRTV	3/15/2004
Antimony	Chronic	4.00E-04	mg/kg/day	0.15	6.00E-05	mg/kg-day	Blood	1000	IRIS	8/29/2005
Arsenic	Chronic	3.00E-04	mg/kg/day	1.00	3.00E-04	mg/kg-day	Skin	3	IRIS	8/29/2005
Barium	Chronic	2.00E-01	mg/kg/day	0.07	1.40E-02	mg/kg-day	Cardiovascular system, kidney	300	IRIS	8/29/2005
Cadmium (in solid media)	Chronic	1.00E-03	mg/kg/day	0.025	2.50E-05	mg/kg-day	Kidney	10	IRIS	8/29/2005
Cadmium (in water)	Chronic	5.00E-04	mg/kg/day	0.05	2.50E-05	mg/kg-day	Kidney	10	IRIS	8/29/2005
Chromium, total	Chronic	3.00E-03	mg/kg/day	0.013	3.90E-05	mg/kg-day	Gastrointestinal system	900	IRIS [a]	8/29/2005
Copper	Chronic	3.70E-02	mg/kg/day	1.00	3.70E-02	mg/kg-day	Gastrointestinal system	2	HEAST [b]	7/1/1997
Iron	Chronic	3.00E-01	mg/kg/day	1.00	3.00E-01	mg/kg-day	Gastrointestinal system	NQ	NCEA	12/28/2004
Lead	NA	NA	NA	1.00	NA	NA	Central nervous system	NA	IRIS	8/29/2005
Manganese (in sediment or water)	Chronic	2.40E-02	mg/kg/day	0.04	9.60E-04	mg/kg-day	Central nervous system	3	IRIS [c]	8/29/2005
Manganese (in food)	Chronic	1.40E-01	mg/kg/day	0.04	5.60E-03	mg/kg-day	Central nervous system	1	IRIS	8/29/2005
Mercury	Chronic	3.00E-04	mg/kg/day	0.07	2.10E-05	mg/kg-day	Immune system	1000	IRIS [d]	8/29/2005
Selenium	Chronic	5.00E-03	mg/kg/day	1.00	5.00E-03	mg/kg-day	:entral nervous system, Liver, Ski	3	IRIS	8/29/2005
Thallium	Chronic	6.60E-05	mg/kg/day	1.00	6.60E-05	mg/kg-day	Liver	3000	PRG	12/28/2004
Vanadium	Chronic	1.00E-03	mg/kg/day	0.03	2.60E-05	mg/kg-day	Whole body	NQ	NCEA	12/28/2004
Zinc	Chronic	3.00E-01	mg/kg/day	1.00	3.00E-01	mg/kg-day	Blood	3	IRIS	8/29/2005
Chloroform	Chronic	1.00E-02	mg/kg/day	1.00	1.00E-02	mg/kg-day	Liver	100	IRIS	8/29/2005
Hexachlorocyclohexane, alpha-	Chronic	5.00E-04	mg/kg/day	1.00	5.00E-04	mg/kg-day	Kidney, Liver	NQ	NCEA	12/28/2004
Methylene chloride	Chronic	6.00E-02	mg/kg/day	1.00	6.00E-02	mg/kg-day	Liver	100	IRIS	8/29/2005
Benz(a)anthracene	NA	NA	NA	1.00	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	1.00	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	1.00	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	1.00	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	1.00	NA	NA	NA	NA	NA	NA
Dibenz(ah)anthracene	NA	NA	NA	1.00	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	1.00	NA	NA	NA	NA	NA	NA
Naphthalene	Chronic	2.00E-02	mg/kg/day	1.00	2.00E-02	mg/kg-day	Whole body	3000	IRIS	8/29/2005
Bis(2-ethylhexyl) phthalate	Chronic	2.00E-02	mg/kg/day	1.00	2.00E-02	mg/kg-day	Liver	1000	IRIS	8/29/2005
PCB 1254	Chronic	2.00E-05	mg/kg/day	1.00	2.00E-05	mg/kg-day	Immune system, Eyes, Skin	300	IRIS	8/29/2005
PCBs, total	Chronic	2.00E-05	mg/kg/day	1.00	2.00E-05	mg/kg-day	Immune system, Eyes, Skin	300	IRIS [f]	8/29/2005
DDD, p,p'-	Chronic	2.00E-03	mg/kg/day	1.00	2.00E-03	mg/kg-day	Liver	100	PPRTV	8/29/2005

TABLE 4-1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

RAGS D TABLE 5

GROVE POND / PLOW SHOP POND

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (ABS_{GI}) (1)	Absorbed RfD for Dermal (2)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s)
DDE, p,p'-	Chronic	2.00E-03	mg/kg/day	1.00	2.00E-03	mg/kg-day	Liver	100	PPRTV [g]	8/29/2005

Notes:

(1) Source: EPA 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final

(2) From EPA 2004-- $RfD_{ABS} = RfD_o \times ABS_{GI}$

Additional Notes:

[a] Hexavalent chromium used as a surrogate.

[b] MCLG (1.3 mg/L) * 2 L/day / 70 kg.

[c] Assumes 50% dietary intake.

[d] Mercuric chloride used as a surrogate.

[f] PCB 1254 used as a surrogate.

[g] p,p'-DDD used as a surrogate.

Definitions:
HEAST = Health Effects Assessment Summary Table.
IRIS = Integrated Risk Information System.
NA = not available.
NQ = not quantified
NCEA = National Center for Environmental Assessment.
PRG = USEPA Region 9 Preliminary Remediation Goals.
PPRTV = Provisional Peer Reviewed Toxicity Value.

TABLE 4-2

CANCER TOXICITY DATA -- ORAL/DERMAL

RAGS D TABLE 6

GROVE POND / PLOW SHOP POND

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (ABS_{GI}) (1)	Absorbed Cancer Slope Factor for Dermal (2)		Weight of Evidence/ Cancer Guideline Description (3)	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s)
Aluminum	NC	NC	1.00	NC	NC	NC	NC	NC
Antimony	NC	NC	0.15	NC	NC	NC	NC	NC
Arsenic	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.00	1.50E+00	$(mg/kg\text{-}day)^{-1}$	A	IRIS	8/29/2005
Barium	NC	NC	0.07	NC	NC	NC	NC	NC
Cadmium (in solid media)	NC	NC	0.025	NC	NC	NC	NC	NC
Cadmium (in water)	NC	NC	0.025	NC	NC	NC	NC	NC
Chromium, total	NC	NC	0.013	NC	NC	NC	NC	NC
Copper	NC	NC	1.00	NC	NC	NC	NC	NC
Iron	NC	NC	1.00	NC	NC	NC	NC	NC
Lead	NA	NA	1.00	NA	NA	B2	IRIS [a]	8/29/2005
Manganese (in sediment or water	NC	NC	0.04	NC	NC	NC	NC	NC
Manganese (in food)	NC	NC	0.04	NC	NC	NC	NC	NC
Mercury	NC	NC	0.07	NC	NC	NC	NC	NC
Selenium	NC	NC	1.00	NC	NC	NC	NC	NC
Thallium	NC	NC	1.00	NC	NC	NC	NC	NC
Vanadium	NC	NC	0.03	NC	NC	NC	NC	NC
Zinc	NC	NC	1.00	NC	NC	NC	NC	NC
Chloroform	NA	NA	1.00	NA	NA	B2	IRIS [c]	8/29/2005
Hexachlorocyclohexane, alpha-	6.30E+00	$(mg/kg\text{-}day)^{-1}$	1.00	6.30E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	8/29/2005
Methylene chloride	7.50E-03	$(mg/kg\text{-}day)^{-1}$	1.00	7.50E-03	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	8/29/2005
Benz(a)anthracene	7.30E-01	$(mg/kg\text{-}day)^{-1}$	1.00	7.30E-01	$(mg/kg\text{-}day)^{-1}$	B2	NCEA	12/28/2004
Benzo(a)pyrene	7.30E+00	$(mg/kg\text{-}day)^{-1}$	1.00	7.30E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	8/29/2005
Benzo(b)fluoranthene	7.30E-01	$(mg/kg\text{-}day)^{-1}$	1.00	7.30E-01	$(mg/kg\text{-}day)^{-1}$	B2	NCEA	12/28/2004
Benzo(k)fluoranthene	7.30E-02	$(mg/kg\text{-}day)^{-1}$	1.00	7.30E-02	$(mg/kg\text{-}day)^{-1}$	B2	NCEA	12/28/2004
Chrysene	7.30E-03	$(mg/kg\text{-}day)^{-1}$	1.00	7.30E-03	$(mg/kg\text{-}day)^{-1}$	B2	NCEA	12/28/2004
Dibenz(ah)anthracene	7.30E+00	$(mg/kg\text{-}day)^{-1}$	1.00	7.30E+00	$(mg/kg\text{-}day)^{-1}$	B2	NCEA	12/28/2004
Indeno(1,2,3-cd)pyrene	7.30E-01	$(mg/kg\text{-}day)^{-1}$	1.00	7.30E-01	$(mg/kg\text{-}day)^{-1}$	B2	NCEA	12/28/2004
Naphthalene	NC	NC	1.00	NC	NC	C	IRIS	8/29/2005
Bis(2-ethylhexyl) phthalate	1.40E-02	$(mg/kg\text{-}day)^{-1}$	1.00	1.40E-02	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	8/29/2005
PCB 1254	2.00E+00	$(mg/kg\text{-}day)^{-1}$	1.00	2.00E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS [b]	8/29/2005
PCBs, total	2.00E+00	$(mg/kg\text{-}day)^{-1}$	1.00	2.00E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS [b]	8/29/2005
DDD, p,p'-	2.40E-01	$(mg/kg\text{-}day)^{-1}$	1.00	2.40E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	8/29/2005

TABLE 4-2

CANCER TOXICITY DATA -- ORAL/DERMAL

RAGS D TABLE 6

GROVE POND / PLOW SHOP POND

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (ABS_{GI}) (1)	Absorbed Cancer Slope Factor for Dermal (2)		Weight of Evidence/ Cancer Guideline Description (3)	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s)
DDE, p,p'-	3.40E-01	$(mg/kg\text{-}day)^{-1}$	1.00	3.40E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	8/29/2005

Notes:

(1) Source: EPA 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final

(2) From EPA 2004-- $SF_{ABS} = SF_o / ABS_{GI}$

(3) Weight-of-evidence for classifying the chemical as a human carcinogen.

A = human carcinogen (sufficient evidence from epidemiologic studies to support a causal association between exposure and cancer in humans).

B2 = probable human carcinogen (sufficient evidence of carcinogenicity in animals and inadequate data in humans).

C = possible human carcinogen (limited evidence of carcinogenicity in animals and no data in humans).

Additional Notes:

[a] USEPA recommends that a numeric estimate of carcinogenicity not be used.

[b] RME cancer slope factor for PCBs with high risk and persistence.

[c] USEPA considers the oral reference dose protective against cancer.

Definitions: IRIS = Integrated Risk Information System.

NC = not carcinogenic.

NCEA = National Center for Environmental Assessment.

RME = reasonable maximum exposure.

TABLE 5-1
CUMULATIVE RISK SUMMARY BY RECEPTOR
GROVE POND

Receptor	Medium	Cancer Risk	Chemicals with Risks Greater than 1E-6	Noncancer Hazard Index	Chemicals with Hazard Quotients Greater than 1	Lead Result
Recreational Adult	Sediment	7.E-05	arsenic, benzo(a)pyrene, dibenz(ah)anthracene	0.6	none	Theshold not exceeded
	Surface Water	9.E-06	arsenic, bis(2-ethylhexyl)phthalate	12.5	manganese	NA
	Fish	3.E-05	PCBs, total	2.3	PCBs, total	NA
	Total	**1.E-04**	--	**15.3**	--	NA
Recreational Child	Sediment	6.E-05	arsenic, benzo(a)pyrene	4.0	arsenic	Theshold not exceeded
	Surface Water	2.E-05	arsenic	22.0	manganese	
	Fish	1.E-05	PCBs, total	4.0	mercury, PCBs, total	
	Total	**1.E-04**	--	**30.1**	--	
Subsistance Angler Adult	Fish	**2.E-04**	PCBs, total DDD, p,p'- DDE, p,p'-	**15.1**	mercury PCB, total	NA
Subsistance Angler Child	Fish	**7.E-05**	PCBs, total DDD, p,p'- DDE, p,p'-	**5.3**	mercury PCB, total	**Theshold exceeded**

TABLE 5-2
CUMULATIVE RISK SUMMARY BY RECEPTOR
PLOW SHOP POND

Receptor	Medium	Cancer Risk	Chemicals with Risks Greater than 1E-6	Noncancer Hazard Index	Chemicals with Hazard Quotients Greater than 1	Lead Result
Recreational Adult	Sediment	4.E-04	arsenic benzo(a)pyrene benzo(b)fluoranthene dibenz(ah)anthracene indeno(1,2,3-cd)pyrene	3.1	arsenic chromium	Theshold not exceeded
	Surface Water	1.E-05	arsenic	0.1	None	NA
	Fish	2.E-05	arsenic	3.4	mercury	NA
	Total	**4.E-04**	--	**6.7**	--	NA
Recreational Child	Sediment	4.E-04	arsenic benzo(a)pyrene benzo(b)fluoranthene dibenz(ah)anthracene indeno(1,2,3-cd)pyrene	21.0	arsenic chromium	Theshold not exceeded
	Surface Water	5.E-05	arsenic	1.3	arsenic	
	Fish	7.E-06	arsenic	6.0	mercury	Not a COPC
	Total	**4.E-04**	--	**28.3**	--	NA
Subsistance Angler Adult	Fish	**1.E-04**	arsenic DDE, p,p'-	**22.7**	mercury vanadium	Not a COPC
Subsistance Angler Child	Fish	**5.E-05**	arsenic DDE, p,p'-	**7.9**	mercury	Not a COPC

APPENDIX A

Responses to EPA comments on Draft Human Health Risk Exposure Parameters
Comments received August 9, 2005

EPA COMMENTS:

1. **<u>Tables 1, 4 and un-numbered adolescent surface water table</u>**: There are some discrepancies between the equations in the tables and the dermal guidance. Specifically, DAevent should be mg/cm2-day rather than mg/m3-day. Fraction absorbed (FA) is missing. The conversion factor (CF, l/cm3) should be replaced by t event (hr/day). Please see box 3.2, 3.3, and 3.4 in the dermal guidance. Please provide an example calculation that can be checked by reference to the appendix in the guidance.

   RESPONSE: GF has updated all equations to match those included in the Final RAGS:E guidance. Typographical errors in the units were corrected. GF has included an example of the calculations performed in Appendix B of the human health risk assessment.

2. **<u>Tables 2, 5, and un-numbered adolescent sediment table</u>**: The dermal equation should be replaced by the dermal equation for soil contact from the dermal guidance (box 3.11 and 3.12). Please provide an example calculation that can be checked by reference to the appendix in the guidance.

   RESPONSE: GF has updated all equations to match those included in the Final RAGS:E guidance. GF has included an example of the calculations performed in Appendix B of the human health risk assessment.

3. **<u>Tables 2, 5, and un-numbered adolescent sediment table</u>**: Although the dermal equations will be replaced per item no. 2 above, the conversion factor in the dermal part of these tables should have been 1.00E-06 kg/mg, rather than 1.00E-06 l/cm3.

   RESPONSE: Typographical errors in the units have been corrected.

4. **<u>Tables 2 ,5, and un-numbered adolescent sediment table</u>**: Please provide a copy or URL for EPA, 1995 (Region IV bulletin) and a paragraph supporting this selection.

   RESPONSE: The URL for the cited values is:
   http://www.epa.gov/region4/waste/ots/healtbul.htm
   This reference has been included in the footnotes of the listed tables.

5. **<u>Tables 6</u>**: In the rationale column, change "Residential recreational adult" to "Residential recreational child"

   RESPONSE: GF has changed the term "Residential recreational adult" to "Residential recreational child" in Table 6.

6. **Tables 3 & 6**: In the RME Value column, round 40.95 to 41.

RESPONSE: GF has rounded the value for exposure frequency from 40.95 meals per year to 41 meals per year in these tables.

APPENDIX B

CALCULATION VERIFICATION

Exposure Point: Sediment
Receptor Population: Recreational
Receptor Age: Adult

CDI (mg/kg-day) =
(CSD x IR x FI x EF x ED x CF)/(BW x AT)

Ingestion	CSD	Chemical concentration in sediment	mg/kg	EPC
	IR	Ingestion rate	mg/day	100
	FI	Fraction ingested	unitless	100%
	EF	Exposure Frequency	days/year	65
	ED	Exposure Duration	years	30
	CF	Conversion factor	kg/mg	1.00E-06
	BW	Body weight	kg	70
	AT-C	Averaging time (Cancer)	days	25,550
	AT-N	Averaging time (Noncancer)	days	10,950

DIMENSIONAL ANALYSIS

$$mg/kg\text{-}day = \frac{mg/kg * mg/day * 1 * days/yr * yr * kg/mg}{kg \cdot day}$$

$$mg/kg\text{-}day = mg/kg\text{-}day$$

INTAKE FACTOR EXAMPLE CALCULATION

$$CDI\ (mg/kg\text{-}day) = C_{SD} * \frac{100 * 1 * 65 * 30 * 1E{-6}}{70 * 25,550}$$

$$CDI\ (mg/kg\text{-}day) = C_{SD} * 1.09E{-7}$$

RISK RESULT EXAMPLE CALCULATION

Arsenic Grove Pond: EPC = 158 mg/kg, CSF = 1.5 $(mg/kg\text{-}day)^{-1}$

CDI = 158 mg/kg * 1.09 E-7 = 1.72 E-5 mg/kg-day

Risk = 1.72 E-5 mg/kg-day * 1.5 $(mg/kg\text{-}day)^{-1}$ = 2.58 E-5

CALCULATION VERIFICATION

Exposure Point: Surface Water
Receptor Population: Recreational
Receptor Age: Adult

CDI (mg/kg-day) =
(CSW x IR x ET x EF x ED)/(BW x AT)

Ingestion	C_{SW}	Chemical concentration in surface water	mg/L	EPC
	IR	Ingestion rate - wading	l/hour	0.01
	ET	Exposure time	hours/day	4
	EF	Exposure frequency	days/year	65
	ED	Exposure duration	years	30
	BW	Body weight	kg	70
	AT-C	Averaging time (Cancer)	days	25,550
	AT-N	Averaging time (Noncancer)	days	10,950

DIMENSIONAL ANALYSIS

$$\frac{mg}{Kg\text{-}day} = \frac{mg/L \times L/hour \times hours/day \times days/yr \times years}{Kg \cdot day}$$

$$\frac{mg}{Kg\text{-}day} = mg/kg/day$$

INTAKE FACTOR EXAMPLE CALCULATION

$$CDI(mg/kg\text{-}day) = \frac{C_{sw} \times 0.01\ L/hr \times 4\frac{hrs}{day} \times 65\frac{days}{year} \times 30\ years}{70 \times 25,550}$$

$$= C_{sw} \times 4.36E\text{-}5$$

RISK RESULT EXAMPLE CALCULATION

Arsenic, Grove Pond: EPC = 0.0767 mg/L, $CSF_o = 1.5 (mg/kg\cdot day)^{-1}$

CDI = 0.076 * 4.36E-5 = 3.31E-6

Risk = 3.31E-6 * 1.5 = 5.0E-6

CALCULATION VERIFICATION

Exposure Point: Fish
Receptor Population: Recreational
Receptor Age: Adult

CDI (mg/kg-day) =
(CSfish x IR x FI x EF x ED x CF)/(BW x AT)

Ingestion	CS_{fish}	Chemical concentration in fish tissue	mg/kg	EPC
	IR_{fish}	Fish ingestion rate	g/meal-day	227
	FI	Fraction ingested	unitless	1
	EF	Exposure Frequency	meal-days/year	41
	ED	Exposure Duration	years	30
	CF	Conversion factor	kg/g	1.00E-03
	BW	Body weight	kg	70
	AT-C	Averaging time (Cancer)	days	25,550
	AT-N	Averaging time (Noncancer)	days	10,950

DIMENSIONAL ANALYSIS

$$mg/kg\cdot day = \frac{mg/kg * \frac{g}{meal\text{-}day} * \frac{meal\text{-}day}{yr} * years * \frac{kg}{g}}{kg \cdot day}$$

$$mg/kg\cdot day = mg/kg\cdot day$$

INTAKE FACTOR EXAMPLE CALCULATION

$$CDI(mg/kg\cdot day) = \frac{CS_{fish} * 227 * 1 * 41 * 30 * 1E{-3}}{70 * 25,550}$$

$$CDI(mg/kg\cdot day) = CS_{fish} * 1.56E{-4}$$

RISK RESULT EXAMPLE CALCULATION

PCBs Grove Pond: EPC = 0.086 mg/kg, CSF = 2.0 $(mg/kg\cdot day)^{-1}$

$CDI = 0.086 * 1.56E{-4} = 1.34E{-5}\ (mg/kg\cdot day)$

$Risk = 1.34E{-5}\ mg/kg\cdot day * 2.0\ (mg/kg\cdot day)^{-1}$

$Risk = 2.69E{-5}$

CALCULATION VERIFICATION

Exposure Point: Sediment
Receptor Population: Recreational
Receptor Age: Adult

DAD (mg/kg-day) =
(DAevent x EF x ED x EV x SA)/(BW x AT)
where:
DAevent (mg/cm2-event) =
CSD x CF x AF x ABSd

	DAD	Dermally absorbed dose	mg/kg-day	Calculated
Dermal	DA_{event}	Absorbed dose per enent	mg/cm^2-event	Calculated
	EF	Exposure Frequency	days/year	65
	ED	Exposure Duration	years	30
	EV	Event Frequency	events/day	1
	SA	Surface Area	cm^2	4,500
	BW	Body weight	kg	70
	AT-C	Averaging time (Cancer)	days	25,550
	AT-N	Averaging time (Noncancer)	days	10,950
	CSD	Chemical concentration in sediment	mg/kg	EPC
	CF	Conversion factor	kg/mg	1.00E-06
	AF	Soil-Skin Adherence factor	mg/cm^2-event	1
	ABS_d	Dermal Absorption fraction	unitless	chemical specific

DIMENSIONAL ANALYSIS

DAevent
DAevent (mg/cm2-event) = mg/kg * kg/mg * mg/cm2-event * unitless = mg/cm2-event

DAD
mg/kg-day = (mg/cm2-event * days/year * years * events/day * cm2) / (kg · day) = mg / (kg · day)

INTAKE FACTOR EXAMPLE CALCULATION

Arsenic, ABSd = 3E-2
DAevent = CSD * 1E-6 * 1 * 3E-2 = 3E-8 * CSD
DAD = DAevnt * (65 * 30 * 1 * 4500) / (70 * 25,550) = DAevent * 4.91

RISK RESULT EXAMPLE CALCULATION

Arsenic, Grove Pond EPC = 158 mg/kg, CSF (mg/kg·day)$^{-1}$

DAD(mg/kg)day = 158 * 3E-8 * 4.91

DAD = 2.33 E-5
Risk = 2.33E-5 * 1.5 (mg/kg·day)$^{-1}$ = 3.49E-5
(note: Arsenic ABS_{GI} = 1.0)

CALCULATION VERIFCATION

Exposure Point: Surface Water
Receptor Population: Recreational
Receptor Age: Adult

DAD (mg/kg-day) =
(DAevent x EV x ED x EF x SA)/(BW x AT)
Where
DA_{event} (mg/cm^2-event) =
See Three possible equations

Calculation of DA event for Surface Water

DA event for Organics

where t_{event} is less than or equal to t* then:

Equation 1
DA_{event} (mg/cm^2-event) =
2 x FA x Kp x C_{SW} x CF x (SQRT(6 x tau_{event} x t_{event}/PI))

where t_{event} is greater than t* then:

Equation 2

$$\textit{If } t_{event} > t^*, \textit{ then: } DA_{event} = FA \times K_p \times C_w \left[\frac{t_{event}}{1+B} + 2\,\tau_{event}\left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right] \times CF$$

DA event for Inorganics

DA_{event} (mg/cm^2-event) =
Kp x C_{SW} x CF x t_{event}

Dermal	DA_{event}	Absorbed dose per unit body surface/day	mg/cm^2-~~day~~ event	Calculated
	FA	Fraction absorbed water	unitless	1
	Kp	Permeability coefficient	cm/hour	Chemical specific
	C_{SW}	Chemical concentration in surface water	mg/L	EPC
	CF	Conversion factor	L/cm^3	0.001
	tau_{event}	lag time per event	hours/event	Chemical specific
	t_{event}	Event Duration	hours/event	4
	PI	Value of Pi	unitless	3.14
	t*	Time to reach steady-state (hr) = 2.4 x tau_{even}	hours/event	Chemical specific

CALCULATION VERIFCATION

Exposure Point: Surface Water
Receptor Population: Recreational
Receptor Age: Adult

DIMENSIONAL ANALYSIS

Eq1 - DAevent organic $mg/cm^2event = cm/hour * mg/L * L/cm3(2) * \sqrt{hours/event * hours/event}$
$= mg/cm^2-event$

Eq2 - DAevent organic $mg/cm^2-event = cm/hr * mg/L * [hours/event + hours/event] * L/cm3(2)$
$= mg/cm^2-event$

Eq3 DAevent inorganic $mg/cm^2-event = cm/hr * mg/L * L/cm3 2 * hours/event$
$= mg/cm^2-event$

INTAKE FACTOR EXAMPLE CALCULATION

For DA event using organics equation 1

Example using Bis(2-ethylhexyl)phthalate at Grove Pond

$DAevent = 2 * 1 * 2.5E-2 * 0.035 * 0.001 * \sqrt{\frac{6 * 16.64 * 4}{3.1416}}$

$DAevent = 1.97E-5$

where FA = 1, $K_p = 2.5E-2$, $C_{sw} = 0.35$, CF = 0.001, $tau_{event} = 16.64$, $t_{event} = 4$

*.001

For DA event organics equation 2

Example using Chloroform at Plow Shop Pond

$FA = 1$ $B = 0$
$K_p = 6.8E-3$ $CF = 0.001$
$C_w = 0.00131$
$t_{event} = 4$
$tau_{event} = 0.5$

$DAevent = 1 * 6.8E-3 * 0.00131 * \left(\frac{4}{1+0} + 2 * .5 * \left(\frac{1+3*0+3*0^2}{(1+0)^2}\right)\right)$

$DAevent = 4.45E-8$

For DA event for inorganics

Example using arsenic in Grove Pond

$DAevent = 0.001 * 0.0767 * 0.001 * 4$

$DAevent = 3.1E-7$

$K_p = 0.001$
$C_{sw} = 0.0767$
$CF = 0.001$
$t_{event} = 4$

CALCULATION VERIFCATION

Exposure Point: Surface Water
Receptor Population: Recreational
Receptor Age: Adult

Verification of DAD

DAD (mg/kg-day) =
(DAevent x EV x ED x EF x SA)/(BW x AT)

Dermal	DAD	Dermally absorbed dose	mg/kg-day	Calculated
	DA_{event}	Absorbed dose per unit body surface/day	mg/cm^2-event	Calculated
	EV	Event Frequency	events/day	1
	ED	Exposure duration	years	30
	EF	Exposure frequency	days/year	65
	SA	Surface area	cm^2	4,500
	BW	Body weight	kg	70
	AT-C	Averaging time (Cancer)	days	25,550
	AT-N	Averaging time (Noncancer)	days	5,110

DIMENSIONAL ANALYSIS

$$DAD(mg/kg\text{-}day) = \frac{mg/cm^2\text{-}event \times \frac{events}{day} \times years \times \frac{days}{year} \times cm^2}{kg \cdot day}$$

$$= mg/kg \cdot day$$

INTAKE FACTOR EXAMPLE CALCULATION

$$DAD(mg/kg \cdot day) = DAevent \times \frac{1 \times 30 \times 65 \times 4500}{70 \times 25,550}$$

$$DAD(mg/kg \cdot day) = DA\,event \times 4.91$$

RISK RESULT EXAMPLE CALCULATION

Arsenic, Grove Pond, SW, See DAD for Arsenic from Page 2, $CSF_d = 1.5 (mg/kg \cdot day)^{-1}$

$DAD(mg/kg \cdot day) = 3.1E\text{-}7 \times 4.91$

$DAD = 1.52 E\text{-}6$

$Risk = 1.52E\text{-}6 \times 1.5 = 2.28 E\text{-}6$

APPENDIX C

TABLE C-1

RAGS D TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Sediment
Receptor Population: Recreational
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name	Intake Factors	Times
Ingestion	CSD	Chemical concentration in sediment	mg/kg	EPC	Site Specific	CDI (mg/kg-day) =		
	IR	Ingestion rate	mg/day	100	EPA, 1995 (same as soil)	(CSD x IR x FI x EF x ED x CF)/(BW x AT)		
	FI	Fraction ingested	unitless	100%	Professional Judgment			
	EF	Exposure Frequency	days/year	65	3 days/week for May-Sept			
	ED	Exposure Duration	years	30	Residential recreational adult		Intake Factor-nc	
	CF	Conversion factor	kg/mg	1.00E-06	- -		2.56E-07	X EPC
	BW	Body weight	kg	70	EPA, 1991		Intake Factor-can	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989		1.10E-07	X EPC
	AT-N	Averaging time (Noncancer)	days	10,950	EPA, 1989			
Dermal	DAD	Dermally absorbed dose	mg/kg-day	Calculated	EPA 2004		Intake Factor	
	DA_{event}	Absorbed dose per event	mg/cm²-event	Calculated	EPA 2004	DAD (mg/kg-day) =		
	EF	Exposure Frequency	days/year	65	3 days/week for May-Sept	(DA_{event} x EF x ED x EV x SA)/(BW x AT)	Intake factor 2-NC	
	ED	Exposure Duration	years	30	Residential recreational adult		1.15E+01	X DA_{event}
	EV	Event Frequency	events/day	1	Professional Judgment	where	Intake factor 2-can	
	SA	Surface Area	cm²	4,500	EPA 1997, 2004 (25% of total area)	DA_{event} (mg/cm²-event) =	4.93E+00	X DA_{event}
	BW	Body weight	kg	70	EPA, 1991	CSD x CF x AF x ABS_d		
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989		DA event	
	AT-N	Averaging time (Noncancer)	days	10,950	EPA, 1989		Intake Factor 1-NC	
	CSD	Chemical concentration in sediment	mg/kg	EPC	Site Specific		1.00E-06	X EPC X ABSd
	CF	Conversion factor	kg/mg	1.00E-06	- -			
	AF	Soil-Skin Adherence factor	mg/cm²-event	1	MADEP (2002-B - sediment)		1.00E-06	X EPC X ABSd
	ABS_d	Dermal Absorption fraction	unitless	chemical specific	EPA 2004			

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1995: Supplemental Guidance to RAGS: Region IV Bulletins, Human Health Risk Assessment. EPA Region 4, Atlanta, GA, November 1995

EPA, 1997: EPA Exposure Factors Handbook, 1997.

EPA, 2004: Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final

MADEP 2002-B: Technical Update, Weighted Skin-Soil Adherence Factors.

TABLE C-2

RAGS D TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water
Receptor Population: Recreational
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name	Intake Factors	Times
Ingestion	C_{sw}	Chemical concentration in surface water	mg/L	EPC	Site Specific	CDI (mg/kg-day) =		
	IR	ingestion rate - wading	l/hour	0.01	EPA, 1995 (10ml/hr)	(CSW x IR x ET x EF x ED)/(BW x AT)		
	ET	Exposure time	hours/day	4	Professional Judgment			
	EF	Exposure frequency	days/year	65	Professional Judgment--3 days/week for May-Sept			
	ED	Exposure duration	years	30	Residential recreational adult		Intake Factor-nc	
	BW	Body weight	kg	70	EPA, 1991		1.02E-04	X EPC
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989		Intake Factor-can	
	AT-N	Averaging time (Noncancer)	days	10,950	EPA, 1989		4.39E-05	X EPC
Dermal	DAD	Dermally absorbed dose	mg/kg-day	Calculated	EPA 2004		Intake Factor	
	DA_{event}	Absorbed dose per unit body surface/day	mg/cm^2-event	Calculated	EPA 2004	DAD (mg/kg-day) =		
	EV	Event Frequency	events/day	1	Professional Judgment	$(DA_{event}$ x EV x ED x EF x SA)/(BW x AT)		
	ED	Exposure duration	years	30	Residential recreational adult		Intake factor 2-NC	
	EF	Exposure frequency	days/year	65	Professional Judgment--3 days/week for May-Sept		2.45E+01	X DA_{event}
	SA	Surface area	cm^2	4,500	EPA 1997, 2004 (25% of total area)	For organics:	Intake factor 2-can	
	BW	Body weight	kg	70	EPA, 1991	If t_{event} is less than or equal to t* then:	4.91E+00	X DA_{event}
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	DA_{event} (mg/cm^2-event) =		
	AT-N	Averaging time (Noncancer)	days	5,110	EPA, 1989	2 x FA x Kp x C_{sw} x CF x (SQRT(6 x tau_{event} x t_{event}/PI))	DA event	
	FA	Fraction absorbed water	unitless	1	EPA 2004 (assume no desquamation)	If t_{event} is greater than t* then:	See separate sheet	
	Kp	Permeability coefficient	cm/hour	Chemical specific	- -			
	C_{sw}	Chemical concentration in surface water	mg/L	EPC	Site Specific			
	CF	Conversion factor	L/cm^3	0.001	Converts L to cm^3			
	tau_{event}	lag time per event	hours/event	Chemical specific	- -	For inorganics:		
	t_{event}	Event Duration	hours/event	4	Professional Judgment	DA_{event} (mg/cm^2-event) =		
	PI	Value of Pi	unitless	3.14	- -	Kp x C_{sw} x CF x t_{event}		
	t*	Time to reach steady-state (hr) = 2.4 x tau_{event}	hours/event	Chemical specific	- -			

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1995: Supplemental Guidance to RAGS: Region IV Bulletins, Human Health Risk Assessment, EPA Region 4, Atlanta, GA, November 1995 http://www.epa.gov/region4/waste/ots/healtbul.htm

EPA, 1997: EPA Exposure Factors Handbook, 1997.

EPA, 2004: Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final

TABLE C-3

RAGS D TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Fish
Exposure Medium: Fish
Exposure Point: Fish
Receptor Population: Recreational
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name	Intake Factors	Times
Ingestion	CS_{fish}	Chemical concentration in fish tissue	mg/kg	EPC	Site Specific	CDI (mg/kg-day) =		
	IR_{fish}	Fish ingestion rate	g/meal-day	227	EPA, 2000 (8 oz portion for and adult)	$(CS_{fish}$ x IR x FI x EF x ED x CF)/(BW x AT)		
	FI	Fraction ingested	unitless	1	Professional Judgment			
	EF	Exposure Frequency	meal-days/year	41	1.05 meal/week (EPA, 1997-Table 10-63/ 90th percentile) for 9 temperate months of the year (39 weeks)			
	ED	Exposure Duration	years	30	Residential recreational adult		Intake Factor-nc	
	CF	Conversion factor	kg/g	1.00E-03	- -		3.64E-04	X EPC
	BW	Body weight	kg	70	EPA, 1991		Intake Factor-can	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989		1.56E-04	X EPC
	AT-N	Averaging time (Noncancer)	days	10,950	EPA, 1989 (ED * 365)			

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1997: EPA Exposure Factors Handbook. 1997.

EPA, 2000: Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume II Risk Assessment and Fish Consumption Limits, Third Edition.

TABLE C-4

RAGS D TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Sediment
Receptor Population: Recreational User
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name	Intake Factors	Times
Ingestion	CSD	Chemical concentration in sediment	mg/kg	EPC	Site Specific	CDI (mg/kg-day) =		
	IR	Ingestion rate	mg/day	200	EPA, 1995 (same as soil)	(CSD x IR x FI x EF x ED x CF)/(BW x AT)		
	FI	Fraction ingested	unitless	100%	Professional Judgment			
	EF	Exposure Frequency	days/year	65	3 days/week for May-Sept			
	ED	Exposure Duration	years	6	Used EPA 1991 value for residential child		Intake Factor-nc	
	CF	Conversion factor	kg/mg	1.00E-06	- -		2.39E-06	X EPC
	BW	Body weight	kg	15	EPA, 1991		Intake Factor-can	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989		2.05E-07	X EPC
	AT-N	Averaging time (Noncancer)	days	2,190	EPA, 1989			
	DAD	Dermally absorbed dose	mg/kg-day	Calculated	EPA 2004		Intake Factor	
Dermal	DA_{event}	Absorbed dose per event	mg/cm^2-event	Calculated	EPA 2004	DAD (mg/kg-day) =		
	EF	Exposure Frequency	days/year	65	3 days/week for May-Sept	(DA_{event} x EF x ED x EV x SA)/(BW x AT)	Intake factor 2-NC	
	ED	Exposure Duration	years	6	Used EPA 1991 value for residential child		1.97E+01	X DA_{event}
	EV	Event Frequency	events/day	1	Professional Judgment	where	Intake factor 2-can	
	SA	Surface Area	cm^2	1,850	25% of the average (male and female) of 50[th] percentile total body surface areas for age = 0 to 6 years (USEPA, 2004).	DA_{event} (mg/cm^2-event) =	1.69E+00	X DA_{event}
	BW	Body weight	kg	15	EPA, 1991	CSD x CF x AF x ABS_d		
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989		DA event	
	AT-N	Averaging time (Noncancer)	days	2,190	EPA, 1989		Intake Factor 1-NC	
	CSD	Chemical concentration in sediment	mg/kg	EPC	Site Specific		1.00E-06	X EPC X ABSd
	CF	Conversion factor	kg/mg	1.00E-06	- -			
	AF	Soil-Skin Adherence factor	mg/cm^2-event	1	MADEP (2002-B - sediment)		1.00E-06	X EPC X ABSd
	ABS_d	Dermal Absorption fraction	unitless	chemical specific	EPA 2004			

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1995: Supplemental Guidance to RAGS: Region IV Bulletins, Human Health Risk Assessment, EPA Region 4, Atlanta, GA, November 1995

EPA, 1997: EPA Exposure Factors Handbook, 1997.

EPA, 2004: Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final

MADEP 2002-B: Technical Update, Weighted Skin-Soil Adherence Factors.

TABLE C-5

RAGS D TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Surface Water
Receptor Population: Recreational User
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name	Intake Factors	Times
Ingestion	CSW	Chemical concentration in surface water	mg/L	EPC	Site Specific	CDI (mg/kg-day) =		
	IR	Ingestion rate - wading	l/hour	0.05	EPA, 1998 (50ml/hr)	(CSW x IR x ET x EF x ED)/(BW x AT)		
	ET	Exposure Time	hours/day	4	Professional Judgment			
	EF	Exposure Frequency	days/year	65	Professional Judgment--3 days/week for May-Sept			
	ED	Exposure Duration	years	6	EPA, 1991		Intake Factor-nc	
	BW	Body weight	kg	15	EPA, 1991		2.39E-03	X EPC
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989		Intake Factor-can	
	AT-N	Averaging time (Noncancer)	days	2,190	EPA, 1989		2.05E-04	X EPC
	DAD	Dermally absorbed dose	mg/kg-day	Calculated	EPA 2004		Intake Factor	
Dermal	DA_{event}	Absorbed dose per unit body surface/day	mg/cm^2-event	Calculated	EPA 2004	DAD (mg/kg-day) =		
	EV	Event Frequency	events/day	1	Professional Judgment	(DA_{event} x EV x ED x EF x SA)/(BW x AT)		
	ED	Exposure duration	years	6	Recreational child		Intake factor 2-NC	
	EF	Exposure frequency	days/year	65	Professional Judgment--3 days/week for May-Sept		1.96E+01	X DA_{event}
	SA	Surface area	cm^2	1,650	EPA 1997, 2004 (25% of total area)	For organics:	Intake factor 2-can	
	BW	Body weight	kg	15	EPA, 1991	If t_{event} is less than or equal to t* then:	1.68E+00	X DA_{event}
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989	DA_{event} (mg/cm^2-event) =		
	AT-N	Averaging time (Noncancer)	days	2,190	EPA, 1989	2 x FA x Kp x C_{sw} x CF x (SQRT(6 x tau_{event} x t_{event}/PI))	DA event	
	FA	Fraction absorbed water	unitless	1	EPA 2004 (assume no desquamation)		See separate Sheet	
	Kp	Permeability coefficient	cm/hour	Chemical specific	--			
	C_{sw}	Chemical concentration in surface water	mg/L	EPC	Site Specific			
	CF	Conversion factor	L/cm^3	0.001	Converts L to cm^3			
	tau_{event}	lag time per event	hours/event	Chemical specific	--	For inorganics:		
	t_{event}	Event Duration	hours/event	4	Professional Judgment	DA_{event} (mg/cm^2-event) =		
	PI	Value of Pi	unitless	3.14	--	Kp x C_{sw} x CF x t_{event}		
	t*	Time to reach steady-state (hr) = 2.4 x tau_{event}	hours/event	Chemical specific	--			

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1995: Supplemental Guidance to RAGS: Region IV Bulletins, Human Health Risk Assessment, EPA Region 4, Atlanta, GA, November 1995 http://www.epa.gov/region4/waste/ots/healtbul.htm

EPA, 1997: EPA Exposure Factors Handbook, 1997.

EPA, 2004: Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final

TABLE C-6

RAGS D TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Fish
Exposure Medium: Fish
Exposure Point: Fish
Receptor Population: Recreational
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name	Intake Factors	Times
Ingestion	CS_{fish}	Chemical concentration in fish tissue	mg/kg	EPC	Site Specific	CDI (mg/kg-day) =		
	IR_{fish}	Fish ingestion rate	g/meal-day	85	EPA, 2000 (3 oz portion for a child)	$(CS_{fish}$ x IR x FI x EF x ED x CF)/(BW x AT)		
	FI	Fraction ingested	unitless	1	Professional Judgment			
	EF	Exposure Frequency	meal-days/year	41	1.05 meal/week (EPA, 1997-Table 10-63/ 90th percentile) for 9 temperate months of the year (39 weeks)			
	ED	Exposure Duration	years	6	Residential recreational child		Intake Factor-nc	
	CF	Conversion factor	kg/g	1.00E-03	- -		6.37E-04	X EPC
	BW	Body weight	kg	15	EPA, 1991		Intake Factor-can	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989		5.46E-05	X EPC
	AT-N	Averaging time (Noncancer)	days	2,190	EPA, 1989			

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1997: EPA Exposure Factors Handbook, 1997.

EPA, 2000: Guidance for Assessing Chemical Contaminant Data for Use In Fish Advisories: Volume II Risk Assessment and Fish Consupmption Limits, Third Edition.

TABLE C-7

RAGS D TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Fish
Exposure Medium: Fish
Exposure Point: Fish
Receptor Population: Subsistence
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name	Intake Factors	Times
Ingestion	CS_{fish}	Chemical concentration in fish tissue	mg/kg	EPC	Site Specific	CDI (mg/kg-day) =		
	IR_{fish}	Fish ingestion rate	g/meal-day	227	EPA, 2000 (8 oz portion for and adult)	(CS_{fish} x IR x FI x EF x ED x CF)/(BW x AT)		
	FI	Fraction ingested	unitless	1	Professional Judgment			
	EF	Exposure Frequency	meal-days/year	273	Assumed 7 meals/week for 9 temperate months of the year (39 weeks)			
	ED	Exposure Duration	years	30	EPA 1991 for Residential adult		Intake Factor-nc	
	CF	Conversion factor	kg/g	1.00E-03	- -		2.43E-03	X EPC
	BW	Body weight	kg	70	EPA, 1991		Intake Factor-can	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989		1.04E-03	X EPC
	AT-N	Averaging time (Noncancer)	days	10,950	EPA, 1989			

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1997: EPA Exposure Factors Handbook, 1997.

EPA, 2000: Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume II Risk Assessment and Fish Consupmption Limits, Third Edition.

TABLE C-8

RAGS D TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Medium: Fish
Exposure Medium: Fish
Exposure Point: Fish
Receptor Population: Subsistence
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name	Intake Factors	Times
Ingestion	CS_{fish}	Chemical concentration in fish tissue	mg/kg	EPC	Site Specific	CDI (mg/kg-day) =		
	IR_{fish}	Fish ingestion rate	g/meal-day	85	EPA, 2000 (3 oz portion for a child)	$(CS_{fish} \times IR \times FI \times EF \times ED \times CF)/(BW \times AT)$		
	FI	Fraction ingested	unitless	1	Professional Judgment			
	EF	Exposure Frequency	meal-days/year	273	Assumed 7 meals/week for 9 temperate months of the year (39 weeks)			
	ED	Exposure Duration	years	6	EPA 1991 for Residential child		Intake Factor-nc	
	CF	Conversion factor	kg/g	1.00E-03	- -		8.48E-04	X EPC
	BW	Body weight	kg	15	EPA, 1991		Intake Factor-can	
	AT-C	Averaging time (Cancer)	days	25,550	EPA, 1989		3.63E-04	X EPC
	AT-N	Averaging time (Noncancer)	days	10,950	EPA, 1989			

Notes:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: EPA Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03, March 25, 1991.

EPA, 1996: EPA Soil Screening Guidance: Technical Background Document, May 1996.

EPA, 2000: Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume II Risk Assessment and Fish Consupmption Limits, Third Edition.

TABLE C-9 Grove Pond
Recreational Adult
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	20300	mg/kg	1.10E-07			2.23E-03		NC	NC	
	Antimony	11.9	mg/kg	1.10E-07			1.30E-06		NC	NC	
	Arsenic	158	mg/kg	1.10E-07			1.73E-05		1.50E+00	(mg/kg-day)-1	2.60E-05
	Barium	0	mg/kg	1.10E-07			0.00E+00		NC	NC	
	Cadmium (in solid media)	48.6	mg/kg	1.10E-07			5.33E-06		NC	NC	
	Cadmium (in water)								NC	NC	
	Chromium, total	144	mg/kg	1.10E-07			1.58E-05		NC	NC	
	Copper	795	mg/kg	1.10E-07			8.72E-05		NC	NC	
	Iron	19100	mg/kg	1.10E-07			2.09E-03		NC	NC	
	Lead	382	mg/kg	1.10E-07			4.19E-05		NA	NA	
	Manganese (in sediment or water)	721	mg/kg	1.10E-07			7.90E-05		NC	NC	
	Manganese (in food)	0	mg/kg	1.10E-07			0.00E+00		NC	NC	
	Mercury	94.4	mg/kg	1.10E-07			1.03E-05		NC	NC	
	Selenium	9.76	mg/kg	1.10E-07			1.07E-06		NC	NC	
	Thallium	26.4	mg/kg	1.10E-07			2.89E-06		NC	NC	
	Vanadium	42.7	mg/kg	1.10E-07			4.68E-06		NC	NC	
	Zinc	0	mg/kg	1.10E-07			0.00E+00		NC	NC	
	Chloroform	0	mg/kg	1.10E-07			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	1.10E-07			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/kg	1.10E-07			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0.684	mg/kg	1.10E-07			7.50E-08		7.30E-01	(mg/kg-day)-1	5.47E-08
	Benzo(a)pyrene	0.729	mg/kg	1.10E-07			7.99E-08		7.30E+00	(mg/kg-day)-1	5.83E-07
	Benzo(b)fluoranthene	0.85	mg/kg	1.10E-07			9.32E-08		7.30E-01	(mg/kg-day)-1	6.80E-08
	Benzo(k)fluoranthene	0.839	mg/kg	1.10E-07			9.20E-08		7.30E-02	(mg/kg-day)-1	6.71E-09
	Chrysene	1.1	mg/kg	1.10E-07			1.21E-07		7.30E-03	(mg/kg-day)-1	8.80E-10
	Dibenz(ah)anthracene	0.263	mg/kg	1.10E-07			2.88E-08		7.30E+00	(mg/kg-day)-1	2.10E-07
	Indeno(1,2,3-cd)pyrene	0.641	mg/kg	1.10E-07			7.03E-08		7.30E-01	(mg/kg-day)-1	5.13E-08
	Naphthalene	3.84	mg/kg	1.10E-07			4.21E-07		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	1.10E-07			0.00E+00		1.40E-02	(mg/kg-day)-1	
	PCB 1254	0	mg/kg	1.10E-07			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/kg	1.10E-07			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0.381	mg/kg	1.10E-07			4.18E-08		2.40E-01	(mg/kg-day)-1	1.00E-08
	DDE, p,p'-	0	mg/kg	1.10E-07			0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
Total											2.70E-05

TABLE C-9 Grove Pond
Recreational Adult
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC Value	EPC Units	Cancer Risk Calculations: Intake Factor		Other	Intake Value	Intake Units	CSF/Unit Risk Value	CSF/Unit Risk Units	Cancer Risk
				Intake Factor	DA event factor	ABSd	Intake		CSF/Unit Risk		Cancer Risk
Dermal	Aluminum	20300	mg/kg	4.93E+00	1.00E-06	....	#VALUE!		NC	NC	
	Antimony	11.9	mg/kg	4.93E+00	1.00E-06	....	#VALUE!		NC	NC	
	Arsenic	158	mg/kg	4.93E+00	1.00E-06	3.00E-02	2.34E-05		1.50E+00	(mg/kg-day)-1	3.51E-05
	Barium	0	mg/kg	4.93E+00	1.00E-06	....	#VALUE!		NC	NC	
	Cadmium (in solid media)	48.6	mg/kg	4.93E+00	1.00E-06	1.00E-03	2.40E-07		NC	NC	
	Cadmium (in water)					NA			NC	NC	
	Chromium, total	144	mg/kg	4.93E+00	1.00E-06	....	#VALUE!		NC	NC	
	Copper	795	mg/kg	4.93E+00	1.00E-06	....	#VALUE!		NC	NC	
	Iron	19100	mg/kg	4.93E+00	1.00E-06	....	#VALUE!		NC	NC	
	Lead	362	mg/kg	4.93E+00	1.00E-06	....	#VALUE!		NA	NA	
	Manganese (in sediment or water)	721	mg/kg	4.93E+00	1.00E-06	....	#VALUE!		NC	NC	
	Manganese (in food)	0	mg/kg	4.93E+00	1.00E-06	....	#VALUE!		NC	NC	
	Mercury	94.4	mg/kg	4.93E+00	1.00E-06	....	#VALUE!		NC	NC	
	Selenium	9.76	mg/kg	4.93E+00	1.00E-06	....	#VALUE!		NC	NC	
	Thallium	26.4	mg/kg	4.93E+00	1.00E-06	....	#VALUE!		NC	NC	
	Vanadium	42.7	mg/kg	4.93E+00	1.00E-06	....	#VALUE!		NC	NC	
	Zinc	0	mg/kg	4.93E+00	1.00E-06	....	#VALUE!		NC	NC	
	Chloroform	0	mg/kg	4.93E+00	1.00E-06	....	#VALUE!		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	4.93E+00	1.00E-06	4.00E-02	0.00E+00		6.30E+00	(mg/kg-day)-1	
	Methylene chloride	0	mg/kg	4.93E+00	1.00E-06	....	#VALUE!		7.50E-03	(mg/kg-day)-1	
	Benz(a)anthracene	0.684	mg/kg	4.93E+00	1.00E-06	1.30E-01	4.39E-07		7.30E-01	(mg/kg-day)-1	3.20E-07
	Benzo(a)pyrene	0.729	mg/kg	4.93E+00	1.00E-06	1.30E-01	4.68E-07		7.30E+00	(mg/kg-day)-1	3.41E-06
	Benzo(b)fluoranthene	0.85	mg/kg	4.93E+00	1.00E-06	1.30E-01	5.45E-07		7.30E-01	(mg/kg-day)-1	3.98E-07
	Benzo(k)fluoranthene	0.839	mg/kg	4.93E+00	1.00E-06	1.30E-01	5.38E-07		7.30E-02	(mg/kg-day)-1	3.93E-08
	Chrysene	1.1	mg/kg	4.93E+00	1.00E-06	1.30E-01	7.05E-07		7.30E-03	(mg/kg-day)-1	5.15E-09
	Dibenz(ah)anthracene	0.263	mg/kg	4.93E+00	1.00E-06	1.30E-01	1.69E-07		7.30E+00	(mg/kg-day)-1	1.23E-06
	Indeno(1,2,3-cd)pyrene	0.641	mg/kg	4.93E+00	1.00E-06	1.30E-01	4.11E-07		7.30E-01	(mg/kg-day)-1	3.00E-07
	Naphthalene	3.84	mg/kg	4.93E+00	1.00E-06	1.30E-01	2.46E-06		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	4.93E+00	1.00E-06	1.00E-01	0.00E+00		1.40E-02	(mg/kg-day)-1	
	PCB 1254	0	mg/kg	4.93E+00	1.00E-06	1.40E-01	0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/kg	4.93E+00	1.00E-06	1.40E-01	0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0.381	mg/kg	4.93E+00	1.00E-06	3.00E-02	5.64E-08		2.40E-01	(mg/kg-day)-1	1.35E-08
	DDE, p,p'-	0	mg/kg	4.93E+00	1.00E-06	3.00E-02	0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
											4.08E-05
Grand Total											6.78E-05

TABLE C-9 Grove Pond
Recreational Adult
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	

TABLE C-9 Grove Pond
Recreational Adult
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	20300	mg/kg	2.56E-07			5.19E-03	mg/kg-day	1.00E+00	mg/kg/day	5.19E-03
	Antimony	11.9	mg/kg	2.56E-07			3.04E-06	mg/kg-day	4.00E-04	mg/kg/day	7.61E-03
	Arsenic	158	mg/kg	2.56E-07			4.04E-05	mg/kg-day	3.00E-04	mg/kg/day	1.35E-01
	Barium	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	48.6	mg/kg	2.56E-07			1.24E-05	mg/kg-day	1.00E-03	mg/kg/day	1.24E-02
	Cadmium (in water)			2.56E-07			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	144	mg/kg	2.56E-07			3.68E-05	mg/kg-day	3.00E-03	mg/kg/day	1.23E-02
	Copper	795	mg/kg	2.56E-07			2.03E-04	mg/kg-day	3.70E-02	mg/kg/day	5.50E-03
	Iron	19100	mg/kg	2.56E-07			4.89E-03	mg/kg-day	3.00E-01	mg/kg/day	1.63E-02
	Lead	382	mg/kg	2.56E-07			9.77E-05	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	721	mg/kg	2.56E-07			1.84E-04	mg/kg-day	2.40E-02	mg/kg/day	7.68E-03
	Manganese (in food)	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	94.4	mg/kg	2.56E-07			2.41E-05	mg/kg-day	3.00E-04	mg/kg/day	8.05E-02
	Selenium	9.76	mg/kg	2.56E-07			2.50E-06	mg/kg-day	5.00E-03	mg/kg/day	4.99E-04
	Thallium	26.4	mg/kg	2.56E-07			6.75E-06	mg/kg-day	6.60E-05	mg/kg/day	1.02E-01
	Vanadium	42.7	mg/kg	2.56E-07			1.09E-05	mg/kg-day	1.00E-03	mg/kg/day	1.09E-02
	Zinc	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha-	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	0.684	mg/kg	2.56E-07			1.75E-07	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0.729	mg/kg	2.56E-07			1.86E-07	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0.85	mg/kg	2.56E-07			2.17E-07	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0.839	mg/kg	2.56E-07			2.15E-07	mg/kg-day	NA	NA	
	Chrysene	1.1	mg/kg	2.56E-07			2.81E-07	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0.263	mg/kg	2.56E-07			6.73E-08	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0.641	mg/kg	2.56E-07			1.64E-07	mg/kg-day	NA	NA	
	Naphthalene	3.84	mg/kg	2.56E-07			9.82E-07	mg/kg-day	2.00E-02	mg/kg/day	4.91E-05
	Bis(2-ethylhexyl) phthalate	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	DDD, p,p'-	0.381	mg/kg	2.56E-07			9.75E-08	mg/kg-day	2.00E-03	mg/kg/day	4.87E-05
	DDE, p,p'-	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
Total											3.98E-01

TABLE C-9 Grove Pond
Recreational Adult
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
				Intake Factor	DA event factor	ABSd	Intake		RfD/RfC		Hazard Quotient
Dermal	Aluminum	20300	mg/kg	1.15E+01	1.00E-06	----------	#VALUE!	mg/kg-day	1.00E+00	mg/kg-day	
	Antimony	11.9	mg/kg	1.15E+01	1.00E-06	----------	#VALUE!	mg/kg-day	6.00E-05	mg/kg-day	
	Arsenic	158	mg/kg	1.15E+01	1.00E-06	3.00E-02	5.46E-05	mg/kg-day	3.00E-04	mg/kg-day	1.82E-01
	Barium	0	mg/kg	1.15E+01	1.00E-06	----------	#VALUE!	mg/kg-day	1.40E-02	mg/kg-day	
	Cadmium (in solid media)	48.6	mg/kg	1.15E+01	1.00E-06	1.00E-03	5.59E-07	mg/kg-day	2.50E-05	mg/kg-day	2.24E-02
	Cadmium (in water)			1.15E+01	1.00E-06	NA	#VALUE!	mg/kg-day	2.50E-05	mg/kg-day	
	Chromium, total	144	mg/kg	1.15E+01	1.00E-06	----------	#VALUE!	mg/kg-day	3.90E-05	mg/kg-day	
	Copper	795	mg/kg	1.15E+01	1.00E-06	----------	#VALUE!	mg/kg-day	3.70E-02	mg/kg-day	
	Iron	19100	mg/kg	1.15E+01	1.00E-06	----------	#VALUE!	mg/kg-day	3.00E-01	mg/kg-day	
	Lead	382	mg/kg	1.15E+01	1.00E-06	----------	#VALUE!	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	721	mg/kg	1.15E+01	1.00E-06	----------	#VALUE!	mg/kg-day	9.60E-04	mg/kg-day	
	Manganese (in food)	0	mg/kg	1.15E+01	1.00E-06	----------	#VALUE!	mg/kg-day	5.60E-03	mg/kg-day	
	Mercury	94.4	mg/kg	1.15E+01	1.00E-06	----------	#VALUE!	mg/kg-day	2.10E-05	mg/kg-day	
	Selenium	9.76	mg/kg	1.15E+01	1.00E-06	----------	#VALUE!	mg/kg-day	5.00E-03	mg/kg-day	
	Thallium	26.4	mg/kg	1.15E+01	1.00E-06	----------	#VALUE!	mg/kg-day	6.60E-05	mg/kg-day	
	Vanadium	42.7	mg/kg	1.15E+01	1.00E-06	----------	#VALUE!	mg/kg-day	2.60E-05	mg/kg-day	
	Zinc	0	mg/kg	1.15E+01	1.00E-06	----------	#VALUE!	mg/kg-day	3.00E-01	mg/kg-day	
	Chloroform	0	mg/kg	1.15E+01	1.00E-06	----------	#VALUE!	mg/kg-day	1.00E-02	mg/kg-day	
	Hexachlorocyclohexane, alpha-	0	mg/kg	1.15E+01	1.00E-06	4.00E-02	0.00E+00	mg/kg-day	5.00E-04	mg/kg-day	0.00E+00
	Methylene chloride	0	mg/kg	1.15E+01	1.00E-06	----------	#VALUE!	mg/kg-day	6.00E-02	mg/kg-day	
	Benz(a)anthracene	0.684	mg/kg	1.15E+01	1.00E-06	1.30E-01	1.02E-06	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0.729	mg/kg	1.15E+01	1.00E-06	1.30E-01	1.09E-06	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0.85	mg/kg	1.15E+01	1.00E-06	1.30E-01	1.27E-06	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0.839	mg/kg	1.15E+01	1.00E-06	1.30E-01	1.26E-06	mg/kg-day	NA	NA	
	Chrysene	1.1	mg/kg	1.15E+01	1.00E-06	1.30E-01	1.65E-06	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0.263	mg/kg	1.15E+01	1.00E-06	1.30E-01	3.94E-07	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0.641	mg/kg	1.15E+01	1.00E-06	1.30E-01	9.59E-07	mg/kg-day	NA	NA	
	Naphthalene	3.84	mg/kg	1.15E+01	1.00E-06	1.30E-01	5.75E-06	mg/kg-day	2.00E-02	mg/kg-day	2.87E-04
	Bis(2-ethylhexyl) phthalate	0	mg/kg	1.15E+01	1.00E-06	1.00E-01	0.00E+00	mg/kg-day	2.00E-02	mg/kg-day	0.00E+00
	PCB 1254	0	mg/kg	1.15E+01	1.00E-06	1.40E-01	0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	PCBs, total	0	mg/kg	1.15E+01	1.00E-06	1.40E-01	0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	DDD, p,p'-	0.381	mg/kg	1.15E+01	1.00E-06	3.00E-02	1.32E-07	mg/kg-day	2.00E-03	mg/kg-day	6.58E-05
	DDE, p,p'-	0	mg/kg	1.15E+01	1.00E-06	3.00E-02	0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
											2.05E-01
Grand Total											6.01E-01

Target organ across all exposure pathways: Central nervous system =	1.34E-02
Target organ across all exposure pathways: Blood =	7.61E-03
Target organ across all exposure pathways: Skin =	3.17E-01
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	3.48E-02
Target organ across all exposure pathways: Gatrointestinal System =	3.41E-02
Target organ across all exposure pathways: Immune system =	8.05E-02
Target organ across all exposure pathways: Liver =	1.02E-01

TABLE C-9 Grove Pond
Recreational Adult
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
						Target organ across all exposure pathways: Whole body/growth =					1.13E-02

TABLE C-10 Grove Pond
Recreational Adult
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Antimony	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Arsenic	0.0767	mg/L	4.39E-05			3.36E-06		1.50E+00	(mg/kg-day)-1	5.05E-06
	Barium	6.99	mg/L	4.39E-05			3.07E-04		NC	NC	
	Cadmium (in solid media)	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Cadmium (in water)		mg/L						NC	NC	
	Chromium, total	0.074	mg/L	4.39E-05			3.25E-06		NC	NC	
	Copper	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Iron	69.2	mg/L	4.39E-05			3.03E-03		NC	NC	
	Lead	0.0117	mg/L	4.39E-05			5.13E-07		NA	NA	
	Manganese (in sediment or water)	112	mg/L	4.39E-05			4.91E-03		NC	NC	
	Manganese (in food)	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Mercury	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Selenium	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Thallium	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Vanadium	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Zinc	7.19	mg/L	4.39E-05			3.15E-04		NC	NC	
	Chloroform	0	mg/L	4.39E-05			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/L	4.39E-05			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/L	4.39E-05			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0	mg/L	4.39E-05			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/L	4.39E-05			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/L	4.39E-05			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/L	4.39E-05			0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/L	4.39E-05			0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/L	4.39E-05			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/L	4.39E-05			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0.035	mg/L	4.39E-05			1.53E-06		1.40E-02	(mg/kg-day)-1	2.15E-08
	PCB 1254	0	mg/L	4.39E-05			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/L	4.39E-05			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/L	4.39E-05			0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0	mg/L	4.39E-05			0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
Total											5.07E-06

TABLE C-10 Grove Pond
Recreational Adult
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
				Intake Factor	DA event		Intake		CSF/Unit Risk		Cancer Risk
Dermal	Aluminum	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Antimony	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Arsenic	0.0767	mg/L	4.91E+00	3.07E-07		1.51E-06		1.50E+00	(mg/kg-day)-1	2.26E-06
	Barium	6.99	mg/L	4.91E+00	2.80E-05		1.37E-04		NC	NC	
	Cadmium (in solid media)	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Cadmium (in water)				0.00E+00		0.00E+00		NC	NC	
	Chromium, total	0.074	mg/L	4.91E+00	5.92E-07		2.90E-06		NC	NC	
	Copper	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Iron	69.2	mg/L	4.91E+00	2.77E-04		1.36E-03		NC	NC	
	Lead	0.0117	mg/L	4.91E+00	4.68E-08		2.30E-07		NA	NA	
	Manganese (in sediment or water)	112	mg/L	4.91E+00	4.48E-04		2.20E-03		NC	NC	
	Manganese (in food)	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Mercury	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Selenium	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Thallium	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Vanadium	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Zinc	7.19	mg/L	4.91E+00	1.73E-05		8.47E-05		NC	NC	
	Chloroform	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/L	4.91E+00	0.00E+00		0.00E+00		6.30E+00	(mg/kg-day)-1	
	Methylene chloride	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E-01	(mg/kg-day)-1	
	Benzo(a)pyrene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0.035	mg/L	4.91E+00	1.97E-05		9.68E-05		1.40E-02	(mg/kg-day)-1	1.36E-06
	PCB 1254	0	mg/L	4.91E+00	0.00E+00		0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/L	4.91E+00	0.00E+00		0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/L	4.91E+00	0.00E+00		0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0	mg/L	4.91E+00	0.00E+00		0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
											3.61E-06
Grand Total											8.68E-06

TABLE C-10 Grove Pond
Recreational Adult
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	1.00E+00	mg/kg/day	0.00E+00
	Antimony	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	4.00E-04	mg/kg/day	0.00E+00
	Arsenic	0.0767	mg/L	1.02E-04			7.85E-06	mg/kg-day	3.00E-04	mg/kg/day	2.62E-02
	Barium	6.99	mg/L	1.02E-04			7.15E-04	mg/kg-day	2.00E-01	mg/kg/day	3.58E-03
	Cadmium (in solid media)	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	1.00E-03	mg/kg/day	0.00E+00
	Cadmium (in water)		mg/L	1.02E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	0.074	mg/L	1.02E-04			7.57E-06	mg/kg-day	3.00E-03	mg/kg/day	2.52E-03
	Copper	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	3.70E-02	mg/kg/day	0.00E+00
	Iron	69.2	mg/L	1.02E-04			7.08E-03	mg/kg-day	3.00E-01	mg/kg/day	2.36E-02
	Lead	0.0117	mg/L	1.02E-04			1.20E-06	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	112	mg/L	1.02E-04			1.15E-02	mg/kg-day	2.40E-02	mg/kg/day	4.77E-01
	Manganese (in food)	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	3.00E-04	mg/kg/day	0.00E+00
	Selenium	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	6.60E-05	mg/kg/day	0.00E+00
	Vanadium	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	1.00E-03	mg/kg/day	0.00E+00
	Zinc	7.19	mg/L	1.02E-04			7.36E-04	mg/kg-day	3.00E-01	mg/kg/day	2.45E-03
	Chloroform	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha-	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0.035	mg/L	1.02E-04			3.58E-06	mg/kg-day	2.00E-02	mg/kg/day	1.79E-04
	PCB 1254	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	DDD, p,p'-	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
	DDE, p,p'-	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
Total											5.36E-01

TABLE C-10 Grove Pond
Recreational Adult
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC Value	EPC Units	Non-Cancer Hazard Calculations: Intake Factor	Other		Intake Value	Intake Units	RfD/RfC Value	RfD/RfC Units	Hazard Quotient
				Intake Factor	DA event		Intake		RfD/RfC		Hazard Quotient
Dermal	Aluminum	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	1.00E+00	mg/kg-day	
	Antimony	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	6.00E-05	mg/kg-day	
	Arsenic	0.0767	mg/L	2.45E+01	3.07E-07		7.53E-06	mg/kg-day	3.00E-04	mg/kg-day	2.51E-02
	Barium	6.99	mg/L	2.45E+01	2.80E-05		6.86E-04	mg/kg-day	1.40E-02	mg/kg-day	4.90E-02
	Cadmium (in solid media)	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.50E-05	mg/kg-day	0.00E+00
	Cadmium (in water)			2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.50E-05	mg/kg-day	
	Chromium, total	0.074	mg/L	2.45E+01	5.92E-07		1.45E-05	mg/kg-day	3.90E-05	mg/kg-day	3.72E-01
	Copper	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	3.70E-02	mg/kg-day	
	Iron	69.2	mg/L	2.45E+01	2.77E-04		6.79E-03	mg/kg-day	3.00E-01	mg/kg-day	2.26E-02
	Lead	0.0117	mg/L	2.45E+01	4.68E-08		1.15E-06	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	112	mg/L	2.45E+01	4.48E-04		1.10E-02	mg/kg-day	9.60E-04	mg/kg-day	1.14E+01
	Manganese (in food)	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	5.60E-03	mg/kg-day	
	Mercury	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.10E-05	mg/kg-day	
	Selenium	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	5.00E-03	mg/kg-day	
	Thallium	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	6.60E-05	mg/kg-day	
	Vanadium	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.60E-05	mg/kg-day	
	Zinc	7.19	mg/L	2.45E+01	1.73E-05		4.23E-04	mg/kg-day	3.00E-01	mg/kg-day	1.41E-03
	Chloroform	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	1.00E-02	mg/kg-day	
	Hexachlorocyclohexane, alpha-	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	5.00E-04	mg/kg-day	
	Methylene chloride	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	6.00E-02	mg/kg-day	
	Benz(a)anthracene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-02	mg/kg-day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0.035	mg/L	2.45E+01	1.97E-05		4.84E-04	mg/kg-day	2.00E-02	mg/kg-day	2.42E-02
	PCB 1254	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	PCBs, total	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	DDD, p,p'-	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
	DDE, p,p'-	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
											1.19E+01
Grand Total											1.25E+01

Target organ across all exposure pathways: Central nervous system =	1.19E+01
Target organ across all exposure pathways: Blood =	3.86E-03
Target organ across all exposure pathways: Skin =	5.12E-02
Target organ across all exposure pathways: Cardiovascular system =	5.26E-02
Target organ across all exposure pathways: Kidney =	0.00E+00
Target organ across all exposure pathways: Gastrointestinal System =	4.21E-01
Target organ across all exposure pathways: Immune system =	0.00E+00
Target organ across all exposure pathways: Liver =	2.44E-02
Target organ across all exposure pathways: Whole body/growth =	0.00E+00

TABLE C-11 Grove Pond
Recreational Adult
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Antimony	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Arsenic	0	mg/kg	1.56E-04			0.00E+00		1.50E+00	(mg/kg-day)-1	0.00E+00
	Barium	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Cadmium (in solid media)	0.0736	mg/kg	1.56E-04			1.15E-05		NC	NC	
	Cadmium (in water)								NC	NC	
	Chromium, total	0.278	mg/kg	1.56E-04			4.34E-05		NC	NC	
	Copper	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Iron	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Lead	0.815	mg/kg	1.56E-04			1.27E-04		NA	NA	
	Manganese (in sediment or water)	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Manganese (in food)	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Mercury	0.497	mg/kg	1.56E-04			7.76E-05		NC	NC	
	Selenium	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Thallium	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Vanadium	0.0715	mg/kg	1.56E-04			1.12E-05		NC	NC	
	Zinc	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Chloroform	0	mg/kg	1.56E-04			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	1.56E-04			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/kg	1.56E-04			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0	mg/kg	1.56E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/kg	1.56E-04			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/kg	1.56E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/kg	1.56E-04			0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/kg	1.56E-04			0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/kg	1.56E-04			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/kg	1.56E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	1.56E-04			0.00E+00		1.40E-02	(mg/kg-day)-1	
	PCB 1254	0	mg/kg	1.56E-04			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0.086	mg/kg	1.56E-04			1.34E-05		2.00E+00	(mg/kg-day)-1	2.69E-05
	DDD, p,p'-	0.0203	mg/kg	1.56E-04			3.17E-06		2.40E-01	(mg/kg-day)-1	7.61E-07
	DDE, p,p'-	0.0424	mg/kg	1.56E-04			6.62E-06		3.40E-01	(mg/kg-day)-1	2.25E-06
Total											2.99E-05
Grand Total											2.99E-05

TABLE C-11 Grove Pond
Recreational Adult
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	1.00E+00	mg/kg/day	0.00E+00
	Antimony	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	4.00E-04	mg/kg/day	0.00E+00
	Arsenic	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	3.00E-04	mg/kg/day	0.00E+00
	Barium	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	0.0736	mg/kg	3.64E-04			2.68E-05	mg/kg-day	1.00E-03	mg/kg/day	2.68E-02
	Cadmium (in water)			3.64E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	0.278	mg/kg	3.64E-04			1.01E-04	mg/kg-day	3.00E-03	mg/kg/day	3.38E-02
	Copper	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	3.70E-02	mg/kg/day	0.00E+00
	Iron	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Lead	0.815	mg/kg	3.64E-04			2.97E-04	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	2.40E-02	mg/kg/day	0.00E+00
	Manganese (in food)	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	0.497	mg/kg	3.64E-04			1.81E-04	mg/kg-day	3.00E-04	mg/kg/day	6.03E-01
	Selenium	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	6.60E-05	mg/kg/day	0.00E+00
	Vanadium	0.0715	mg/kg	3.64E-04			2.60E-05	mg/kg-day	1.00E-03	mg/kg/day	2.60E-02
	Zinc	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha-	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0.086	mg/kg	3.64E-04			3.13E-05	mg/kg-day	2.00E-05	mg/kg/day	1.57E+00
	DDD, p,p'-	0.0203	mg/kg	3.64E-04			7.39E-06	mg/kg-day	2.00E-03	mg/kg/day	3.70E-03
	DDE, p,p'-	0.0424	mg/kg	3.64E-04			1.54E-05	mg/kg-day	2.00E-03	mg/kg/day	7.72E-03
Total											2.27E+00
Grand Total											2.27E+00

Target organ across all exposure pathways: Central nervous system =	0.00E+00
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	0.00E+00
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	2.68E-02
Target organ across all exposure pathways: Gatrointestinal System =	3.38E-02
Target organ across all exposure pathways: Immune system =	2.17E+00
Target organ across all exposure pathways: Liver =	1.14E-02
Target organ across all exposure pathways: Whole body/growth =	2.60E-02

TABLE C-12 Grove Pond
Recreational Child
Sediment

		EPC		Cancer Risk Calculations							
Exposure Route	List of Chemicals of Potential Concern	Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	20300	mg/kg	2.05E-07			4.15E-03		NC	NC	
	Antimony	11.9	mg/kg	2.05E-07			2.44E-06		NC	NC	
	Arsenic	158	mg/kg	2.05E-07			3.23E-05		1.50E+00	(mg/kg-day)-1	4.85E-05
	Barium	0	mg/kg	2.05E-07			0.00E+00		NC	NC	
	Cadmium (in solid media)	48.6	mg/kg	2.05E-07			9.95E-06		NC	NC	
	Cadmium (in water)								NC	NC	
	Chromium, total	144	mg/kg	2.05E-07			2.95E-05		NC	NC	
	Copper	795	mg/kg	2.05E-07			1.63E-04		NC	NC	
	Iron	19100	mg/kg	2.05E-07			3.91E-03		NC	NC	
	Lead	382	mg/kg	2.05E-07			7.82E-05		NA	NA	
	Manganese (in sediment or water)	721	mg/kg	2.05E-07			1.48E-04		NC	NC	
	Manganese (in food)	0	mg/kg	2.05E-07			0.00E+00		NC	NC	
	Mercury	94.4	mg/kg	2.05E-07			1.93E-05		NC	NC	
	Selenium	9.76	mg/kg	2.05E-07			2.00E-06		NC	NC	
	Thallium	26.4	mg/kg	2.05E-07			5.40E-06		NC	NC	
	Vanadium	42.7	mg/kg	2.05E-07			8.74E-06		NC	NC	
	Zinc	0	mg/kg	2.05E-07			0.00E+00		NC	NC	
	Chloroform	0	mg/kg	2.05E-07			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	2.05E-07			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/kg	2.05E-07			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0.684	mg/kg	2.05E-07			1.40E-07		7.30E-01	(mg/kg-day)-1	1.02E-07
	Benzo(a)pyrene	0.729	mg/kg	2.05E-07			1.49E-07		7.30E+00	(mg/kg-day)-1	1.09E-06
	Benzo(b)fluoranthene	0.85	mg/kg	2.05E-07			1.74E-07		7.30E-01	(mg/kg-day)-1	1.27E-07
	Benzo(k)fluoranthene	0.839	mg/kg	2.05E-07			1.72E-07		7.30E-02	(mg/kg-day)-1	1.25E-08
	Chrysene	1.1	mg/kg	2.05E-07			2.25E-07		7.30E-03	(mg/kg-day)-1	1.64E-09
	Dibenz(ah)anthracene	0.263	mg/kg	2.05E-07			5.38E-08		7.30E+00	(mg/kg-day)-1	3.93E-07
	Indeno(1,2,3-cd)pyrene	0.641	mg/kg	2.05E-07			1.31E-07		7.30E-01	(mg/kg-day)-1	9.58E-08
	Naphthalene	3.84	mg/kg	2.05E-07			7.86E-07		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	2.05E-07			0.00E+00		1.40E-02	(mg/kg-day)-1	0.00E+00
	PCB 1254	0	mg/kg	2.05E-07			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/kg	2.05E-07			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0.381	mg/kg	2.05E-07			7.80E-08		2.40E-01	(mg/kg-day)-1	1.87E-08
	DDE, p,p'-	0	mg/kg	2.05E-07			0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
Total											5.03E-05

TABLE C-12 Grove Pond
Recreational Child
Sediment

		EPC		Cancer Risk Calculations							
Exposure Route	**List of Chemicals of Potential Concern**	**Value**	**Units**	**Intake Factor**		**Other**	**Intake**		**CSF/Unit Risk**		**Cancer Risk**
							Value	**Units**	**Value**	**Units**	
				Intake Factor	**DA event factor**	**ABSd**	**Intake**		**CSF/Unit Risk**		**Cancer Risk**
Dermal	Aluminum	20300	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NC	NC	
	Antimony	11.9	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NC	NC	
	Arsenic	158	mg/kg	1.69E+00	1.00E-06	3.00E-02	8.00E-06		1.50E+00	(mg/kg-day)-1	1.20E-05
	Barium	0	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NC	NC	
	Cadmium (in solid media)	48.6	mg/kg	1.69E+00	1.00E-06	1.00E-03	8.21E-08		NC	NC	
	Cadmium (in water)					NA			NC	NC	
	Chromium, total	144	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NC	NC	
	Copper	795	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NC	NC	
	Iron	19100	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NC	NC	
	Lead	382	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NA	NA	
	Manganese (in sediment or water)	721	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NC	NC	
	Manganese (in food)	0	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NC	NC	
	Mercury	94.4	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NC	NC	
	Selenium	9.76	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NC	NC	
	Thallium	26.4	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NC	NC	
	Vanadium	42.7	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NC	NC	
	Zinc	0	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NC	NC	
	Chloroform	0	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	1.69E+00	1.00E-06	4.00E-02	0.00E+00		6.30E+00	(mg/kg-day)-1	
	Methylene chloride	0	mg/kg	1.69E+00	1.00E-06	----------	#VALUE!		7.50E-03	(mg/kg-day)-1	
	Benz(a)anthracene	0.684	mg/kg	1.69E+00	1.00E-06	1.30E-01	1.50E-07		7.30E-01	(mg/kg-day)-1	
	Benzo(a)pyrene	0.729	mg/kg	1.69E+00	1.00E-06	1.30E-01	1.60E-07		7.30E+00	(mg/kg-day)-1	1.17E-06
	Benzo(b)fluoranthene	0.85	mg/kg	1.69E+00	1.00E-06	1.30E-01	1.87E-07		7.30E-01	(mg/kg-day)-1	1.36E-07
	Benzo(k)fluoranthene	0.839	mg/kg	1.69E+00	1.00E-06	1.30E-01	1.84E-07		7.30E-02	(mg/kg-day)-1	1.34E-08
	Chrysene	1.1	mg/kg	1.69E+00	1.00E-06	1.30E-01	2.41E-07		7.30E-03	(mg/kg-day)-1	1.76E-09
	Dibenz(ah)anthracene	0.263	mg/kg	1.69E+00	1.00E-06	1.30E-01	5.77E-08		7.30E+00	(mg/kg-day)-1	4.21E-07
	Indeno(1,2,3-cd)pyrene	0.641	mg/kg	1.69E+00	1.00E-06	1.30E-01	1.41E-07		7.30E-01	(mg/kg-day)-1	1.03E-07
	Naphthalene	3.84	mg/kg	1.69E+00	1.00E-06	1.30E-01	8.43E-07		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	1.69E+00	1.00E-06	1.00E-01	0.00E+00		1.40E-02	(mg/kg-day)-1	
	PCB 1254	0	mg/kg	1.69E+00	1.00E-06	1.40E-01	0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/kg	1.69E+00	1.00E-06	1.40E-01	0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0.381	mg/kg	1.69E+00	1.00E-06	3.00E-02	1.93E-08		2.40E-01	(mg/kg-day)-1	4.63E-09
	DDE, p,p'-	0	mg/kg	1.69E+00	1.00E-06	3.00E-02	0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
											1.39E-05
Grand Total											6.42E-05

TABLE C-12 Grove Pond
Recreational Child
Sediment

		EPC		Non-Cancer Hazard Calculations							
Exposure Route	List of Chemicals of Potential Concern	Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	20300	mg/kg	2.39E-06			4.85E-02	mg/kg-day	1.00E+00	mg/kg/day	4.85E-02
	Antimony	11.9	mg/kg	2.39E-06			2.84E-05	mg/kg-day	4.00E-04	mg/kg/day	7.10E-02
	Arsenic	158	mg/kg	2.39E-06			3.77E-04	mg/kg-day	3.00E-04	mg/kg/day	1.26E+00
	Barium	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	48.6	mg/kg	2.39E-06			1.16E-04	mg/kg-day	1.00E-03	mg/kg/day	1.16E-01
	Cadmium (in water)			2.39E-06			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	144	mg/kg	2.39E-06			3.44E-04	mg/kg-day	3.00E-03	mg/kg/day	1.15E-01
	Copper	795	mg/kg	2.39E-06			1.90E-03	mg/kg-day	3.70E-02	mg/kg/day	5.13E-02
	Iron	19100	mg/kg	2.39E-06			4.56E-02	mg/kg-day	3.00E-01	mg/kg/day	1.52E-01
	Lead	382	mg/kg	2.39E-06			9.12E-04	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	721	mg/kg	2.39E-06			1.72E-03	mg/kg-day	2.40E-02	mg/kg/day	7.17E-02
	Manganese (in food)	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	94.4	mg/kg	2.39E-06			2.25E-04	mg/kg-day	3.00E-04	mg/kg/day	7.51E-01
	Selenium	9.76	mg/kg	2.39E-06			2.33E-05	mg/kg-day	5.00E-03	mg/kg/day	4.66E-03
	Thallium	26.4	mg/kg	2.39E-06			6.30E-05	mg/kg-day	6.60E-05	mg/kg/day	9.55E-01
	Vanadium	42.7	mg/kg	2.39E-06			1.02E-04	mg/kg-day	1.00E-03	mg/kg/day	1.02E-01
	Zinc	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha-	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	0.684	mg/kg	2.39E-06			1.63E-06	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0.729	mg/kg	2.39E-06			1.74E-06	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0.85	mg/kg	2.39E-06			2.03E-06	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0.839	mg/kg	2.39E-06			2.00E-06	mg/kg-day	NA	NA	
	Chrysene	1.1	mg/kg	2.39E-06			2.63E-06	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0.263	mg/kg	2.39E-06			6.28E-07	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0.641	mg/kg	2.39E-06			1.53E-06	mg/kg-day	NA	NA	
	Naphthalene	3.84	mg/kg	2.39E-06			9.17E-06	mg/kg-day	2.00E-02	mg/kg/day	4.58E-04
	Bis(2-ethylhexyl) phthalate	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	DDD, p,p'-	0.381	mg/kg	2.39E-06			9.10E-07	mg/kg-day	2.00E-03	mg/kg/day	4.55E-04
	DDE, p,p'-	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
Total											3.70E+00

TABLE C-12 Grove Pond
Recreational Child
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC Value	EPC Units	Non-Cancer Hazard Calculations: Intake Factor	Other		Intake Value	Intake Units	RfD/RfC Value	RfD/RfC Units	Hazard Quotient
				Intake Factor	DA event factor	ABSd	Intake		RfD/RfC		Hazard Quotient
Dermal	Aluminum	20300	mg/kg	1.97E+01	1.00E-06	--------	#VALUE!	mg/kg-day	1.00E+00	mg/kg-day	
	Antimony	11.9	mg/kg	1.97E+01	1.00E-06	--------	#VALUE!	mg/kg-day	6.00E-05	mg/kg-day	
	Arsenic	158	mg/kg	1.97E+01	1.00E-06	3.00E-02	9.34E-05	mg/kg-day	3.00E-04	mg/kg-day	3.11E-01
	Barium	0	mg/kg	1.97E+01	1.00E-06	--------	#VALUE!	mg/kg-day	1.40E-02	mg/kg-day	
	Cadmium (in solid media)	48.6	mg/kg	1.97E+01	1.00E-06	1.00E-03	9.57E-07	mg/kg-day	2.50E-05	mg/kg-day	3.83E-02
	Cadmium (in water)			1.97E+01	1.00E-06	NA	#VALUE!	mg/kg-day	2.50E-05	mg/kg-day	
	Chromium, total	144	mg/kg	1.97E+01	1.00E-06	--------	#VALUE!	mg/kg-day	3.90E-05	mg/kg-day	
	Copper	795	mg/kg	1.97E+01	1.00E-06	--------	#VALUE!	mg/kg-day	3.70E-02	mg/kg-day	
	Iron	19100	mg/kg	1.97E+01	1.00E-06	--------	#VALUE!	mg/kg-day	3.00E-01	mg/kg-day	
	Lead	382	mg/kg	1.97E+01	1.00E-06	--------	#VALUE!	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	721	mg/kg	1.97E+01	1.00E-06	--------	#VALUE!	mg/kg-day	9.60E-04	mg/kg-day	
	Manganese (in food)	0	mg/kg	1.97E+01	1.00E-06	--------	#VALUE!	mg/kg-day	5.60E-03	mg/kg-day	
	Mercury	94.4	mg/kg	1.97E+01	1.00E-06	--------	#VALUE!	mg/kg-day	2.10E-05	mg/kg-day	
	Selenium	9.76	mg/kg	1.97E+01	1.00E-06	--------	#VALUE!	mg/kg-day	5.00E-03	mg/kg-day	
	Thallium	26.4	mg/kg	1.97E+01	1.00E-06	--------	#VALUE!	mg/kg-day	6.60E-05	mg/kg-day	
	Vanadium	42.7	mg/kg	1.97E+01	1.00E-06	--------	#VALUE!	mg/kg-day	2.60E-05	mg/kg-day	
	Zinc	0	mg/kg	1.97E+01	1.00E-06	--------	#VALUE!	mg/kg-day	3.00E-01	mg/kg-day	
	Chloroform	0	mg/kg	1.97E+01	1.00E-06	--------	#VALUE!	mg/kg-day	1.00E-02	mg/kg-day	
	Hexachlorocyclohexane, alpha-	0	mg/kg	1.97E+01	1.00E-06	4.00E-02	0.00E+00	mg/kg-day	5.00E-04	mg/kg-day	
	Methylene chloride	0	mg/kg	1.97E+01	1.00E-06	--------	#VALUE!	mg/kg-day	6.00E-02	mg/kg-day	
	Benz(a)anthracene	0.684	mg/kg	1.97E+01	1.00E-06	1.30E-01	1.75E-06	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0.729	mg/kg	1.97E+01	1.00E-06	1.30E-01	1.87E-06	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0.85	mg/kg	1.97E+01	1.00E-06	1.30E-01	2.18E-06	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0.839	mg/kg	1.97E+01	1.00E-06	1.30E-01	2.15E-06	mg/kg-day	NA	NA	
	Chrysene	1.1	mg/kg	1.97E+01	1.00E-06	1.30E-01	2.82E-06	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0.263	mg/kg	1.97E+01	1.00E-06	1.30E-01	6.73E-07	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0.641	mg/kg	1.97E+01	1.00E-06	1.30E-01	1.64E-06	mg/kg-day	NA	NA	
	Naphthalene	3.84	mg/kg	1.97E+01	1.00E-06	1.30E-01	9.83E-06	mg/kg-day	2.00E-02	mg/kg-day	4.92E-04
	Bis(2-ethylhexyl) phthalate	0	mg/kg	1.97E+01	1.00E-06	1.00E-01	0.00E+00	mg/kg-day	2.00E-02	mg/kg-day	0.00E+00
	PCB 1254	0	mg/kg	1.97E+01	1.00E-06	1.40E-01	0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	PCBs, total	0	mg/kg	1.97E+01	1.00E-06	1.40E-01	0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	DDD, p,p'-	0.381	mg/kg	1.97E+01	1.00E-06	3.00E-02	2.25E-07	mg/kg-day	2.00E-03	mg/kg-day	1.13E-04
	DDE, p,p'-	0	mg/kg	1.97E+01	1.00E-06	3.00E-02	0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
											3.50E-01
Grand Total											4.05E+00

Target organ across all exposure pathways: Central nervous system =	1.25E-01
Target organ across all exposure pathways: Blood =	7.10E-02
Target organ across all exposure pathways: Skin =	1.57E+00
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	1.54E-01
Target organ across all exposure pathways: Gatrointestinal System =	3.18E-01
Target organ across all exposure pathways: Immune system =	7.51E-01
Target organ across all exposure pathways: Liver =	9.56E-01
Target organ across all exposure pathways: Whole body/growth =	1.03E-01

TABLE C-13 Grove Pond
Recreational Child
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Antimony	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Arsenic	0.0767	mg/L	2.05E-04			1.57E-05		1.50E+00	(mg/kg-day)-1	2.35E-05
	Barium	6.99	mg/L	2.05E-04			1.43E-03		NC	NC	
	Cadmium (in solid media)	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Cadmium (in water)		mg/L						NC	NC	
	Chromium, total	0.074	mg/L	2.05E-04			1.51E-05		NC	NC	
	Copper	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Iron	69.2	mg/L	2.05E-04			1.42E-02		NC	NC	
	Lead	0.0117	mg/L	2.05E-04			2.39E-06		NA	NA	
	Manganese (in sediment or water)	112	mg/L	2.05E-04			2.29E-02		NC	NC	
	Manganese (in food)	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Mercury	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Selenium	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Thallium	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Vanadium	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Zinc	7.19	mg/L	2.05E-04			1.47E-03		NC	NC	
	Chloroform	0	mg/L	2.05E-04			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/L	2.05E-04			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/L	2.05E-04			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0	mg/L	2.05E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/L	2.05E-04			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/L	2.05E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/L	2.05E-04			0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/L	2.05E-04			0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/L	2.05E-04			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/L	2.05E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0.035	mg/L	2.05E-04			7.16E-06		1.40E-02	(mg/kg-day)-1	1.00E-07
	PCB 1254	0	mg/L	2.05E-04			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/L	2.05E-04			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/L	2.05E-04			0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0	mg/L	2.05E-04			0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
Total											2.36E-05

TABLE C-13 Grove Pond
Recreational Child
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC Value	EPC Units	Intake Factor		Other	Intake Value	Intake Units	CSF/Unit Risk Value	CSF/Unit Risk Units	Cancer Risk
				Intake Factor	DA event		Intake		CSF/Unit Risk		Cancer Risk
Dermal	Aluminum	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Antimony	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Arsenic	0.0767	mg/L	1.68E+00	3.07E-07		5.15E-07		1.50E+00	(mg/kg-day)-1	7.73E-07
	Barium	6.99	mg/L	1.68E+00	2.80E-05		4.69E-05		NC	NC	
	Cadmium (in solid media)	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Cadmium (in water)				0.00E+00		0.00E+00		NC	NC	
	Chromium, total	0.074	mg/L	1.68E+00	5.92E-07		9.94E-07		NC	NC	
	Copper	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Iron	69.2	mg/L	1.68E+00	2.77E-04		4.65E-04		NC	NC	
	Lead	0.0117	mg/L	1.68E+00	4.68E-08		7.86E-08		NA	NA	
	Manganese (in sediment or water)	112	mg/L	1.68E+00	4.48E-04		7.52E-04		NC	NC	
	Manganese (in food)	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Mercury	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Selenium	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Thallium	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Vanadium	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Zinc	7.19	mg/L	1.68E+00	1.73E-05		2.90E-05		NC	NC	
	Chloroform	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/L	1.68E+00	0.00E+00		0.00E+00		6.30E+00	(mg/kg-day)-1	
	Methylene chloride	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E-01	(mg/kg-day)-1	
	Benzo(a)pyrene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0.035	mg/L	1.68E+00	1.97E-05		3.31E-05		1.40E-02	(mg/kg-day)-1	4.64E-07
	PCB 1254	0	mg/L	1.68E+00	0.00E+00		0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/L	1.68E+00	0.00E+00		0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/L	1.68E+00	0.00E+00		0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0	mg/L	1.68E+00	0.00E+00		0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
											1.24E-06
Grand Total											2.49E-05

TABLE C-13 Grove Pond
Recreational Child
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	1.00E+00	mg/kg/day	0.00E+00
	Antimony	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	4.00E-04	mg/kg/day	0.00E+00
	Arsenic	0.0767	mg/L	2.39E-03			1.83E-04	mg/kg-day	3.00E-04	mg/kg/day	6.10E-01
	Barium	6.99	mg/L	2.39E-03			1.67E-02	mg/kg-day	2.00E-01	mg/kg/day	8.34E-02
	Cadmium (in solid media)	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	1.00E-03	mg/kg/day	0.00E+00
	Cadmium (in water)		mg/L	2.39E-03			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	0.074	mg/L	2.39E-03			1.77E-04	mg/kg-day	3.00E-03	mg/kg/day	5.89E-02
	Copper	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	3.70E-02	mg/kg/day	0.00E+00
	Iron	69.2	mg/L	2.39E-03			1.65E-01	mg/kg-day	3.00E-01	mg/kg/day	5.51E-01
	Lead	0.0117	mg/L	2.39E-03			2.79E-05	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	112	mg/L	2.39E-03			2.67E-01	mg/kg-day	2.40E-02	mg/kg/day	1.11E+01
	Manganese (in food)	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	3.00E-04	mg/kg/day	0.00E+00
	Selenium	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	6.60E-05	mg/kg/day	0.00E+00
	Vanadium	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	1.00E-03	mg/kg/day	0.00E+00
	Zinc	7.19	mg/L	2.39E-03			1.72E-02	mg/kg-day	3.00E-01	mg/kg/day	5.72E-02
	Chloroform	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha-	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0.035	mg/L	2.39E-03			8.36E-05	mg/kg-day	2.00E-02	mg/kg/day	4.18E-03
	PCB 1254	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	DDD, p,p'-	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
	DDE, p,p'-	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
Total											1.25E+01

TABLE C-13 Grove Pond
Recreational Child
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC Value	EPC Units	Non-Cancer Hazard Calculations: Intake Factor	Other		Intake Value	Intake Units	RfD/RfC Value	RfD/RfC Units	Hazard Quotient
				Intake Factor	DA event		Intake		RfD/RfC		Hazard Quotient
Dermal	Aluminum	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	1.00E+00	mg/kg-day	
	Antimony	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	6.00E-05	mg/kg-day	
	Arsenic	0.0767	mg/L	1.96E+01	3.07E-07		6.01E-06	mg/kg-day	3.00E-04	mg/kg-day	2.00E-02
	Barium	6.99	mg/L	1.96E+01	2.80E-05		5.48E-04	mg/kg-day	1.40E-02	mg/kg-day	3.91E-02
	Cadmium (in solid media)	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.50E-05	mg/kg-day	0.00E+00
	Cadmium (in water)			1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.50E-05	mg/kg-day	
	Chromium, total	0.074	mg/L	1.96E+01	5.92E-07		1.16E-05	mg/kg-day	3.90E-05	mg/kg-day	2.97E-01
	Copper	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	3.70E-02	mg/kg-day	
	Iron	69.2	mg/L	1.96E+01	2.77E-04		5.42E-03	mg/kg-day	3.00E-01	mg/kg-day	1.81E-02
	Lead	0.0117	mg/L	1.96E+01	4.68E-08		9.17E-07	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	112	mg/L	1.96E+01	4.48E-04		8.78E-03	mg/kg-day	9.60E-04	mg/kg-day	9.14E+00
	Manganese (in food)	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	5.60E-03	mg/kg-day	
	Mercury	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.10E-05	mg/kg-day	
	Selenium	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	5.00E-03	mg/kg-day	
	Thallium	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	6.60E-05	mg/kg-day	
	Vanadium	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.60E-05	mg/kg-day	
	Zinc	7.19	mg/L	1.96E+01	1.73E-05		3.38E-04	mg/kg-day	3.00E-01	mg/kg-day	1.13E-03
	Chloroform	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	1.00E-02	mg/kg-day	
	Hexachlorocyclohexane, alpha-	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	5.00E-04	mg/kg-day	
	Methylene chloride	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	6.00E-02	mg/kg-day	
	Benz(a)anthracene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-02	mg/kg-day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0.035	mg/L	1.96E+01	1.97E-05		3.87E-04	mg/kg-day	2.00E-02	mg/kg-day	1.93E-02
	PCB 1254	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	PCBs, total	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	DDD, p,p'-	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
	DDE, p,p'-	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
											9.54E+00
Grand Total											2.20E+01

Target organ across all exposure pathways: Central nervous system =	2.03E+01
Target organ across all exposure pathways: Blood =	5.83E-02
Target organ across all exposure pathways: Skin =	6.30E-01
Target organ across all exposure pathways: Cardiovascular system =	1.23E-01
Target organ across all exposure pathways: Kidney =	0.00E+00
Target organ across all exposure pathways: Gatrointestinal System =	9.25E-01
Target organ across all exposure pathways: Immune system =	0.00E+00
Target organ across all exposure pathways: Liver =	2.35E-02
Target organ across all exposure pathways: Whole body/growth =	0.00E+00

TABLE C-14 Grove Pond
Recreational Child
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Antimony	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Arsenic	0	mg/kg	5.46E-05			0.00E+00		1.50E+00	(mg/kg-day)-1	0.00E+00
	Barium	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Cadmium (in solid media)	0.0736	mg/kg	5.46E-05			4.02E-06		NC	NC	
	Cadmium (in water)								NC	NC	
	Chromium, total	0.278	mg/kg	5.46E-05			1.52E-05		NC	NC	
	Copper	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Iron	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Lead	0.815	mg/kg	5.46E-05			4.45E-05		NA	NA	
	Manganese (in sediment or water)	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Manganese (in food)	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Mercury	0.497	mg/kg	5.46E-05			2.71E-05		NC	NC	
	Selenium	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Thallium	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Vanadium	0.0715	mg/kg	5.46E-05			3.90E-06		NC	NC	
	Zinc	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Chloroform	0	mg/kg	5.46E-05			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	5.46E-05			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/kg	5.46E-05			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0	mg/kg	5.46E-05			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/kg	5.46E-05			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/kg	5.46E-05			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/kg	5.46E-05			0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/kg	5.46E-05			0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/kg	5.46E-05			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/kg	5.46E-05			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	5.46E-05			0.00E+00		1.40E-02	(mg/kg-day)-1	
	PCB 1254	0	mg/kg	5.46E-05			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0.086	mg/kg	5.46E-05			4.69E-06		2.00E+00	(mg/kg-day)-1	9.38E-06
	DDD, p,p'-	0.0203	mg/kg	5.46E-05			1.11E-06		2.40E-01	(mg/kg-day)-1	2.66E-07
	DDE, p,p'-	0.0424	mg/kg	5.46E-05			2.31E-06		3.40E-01	(mg/kg-day)-1	7.87E-07
Total											1.04E-05
Grand Total											1.04E-05

TABLE C-14 Grove Pond
Recreational Child
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC Value	EPC Units	Intake Factor	Other		Intake Value	Intake Units	RfD/RfC Value	RfD/RfC Units	Hazard Quotient
Ingestion	Aluminum	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	1.00E+00	mg/kg/day	0.00E+00
	Antimony	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	4.00E-04	mg/kg/day	0.00E+00
	Arsenic	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	3.00E-04	mg/kg/day	0.00E+00
	Barium	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	0.0736	mg/kg	6.37E-04			4.68E-05	mg/kg-day	1.00E-03	mg/kg/day	4.68E-02
	Cadmium (in water)			6.37E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	0.278	mg/kg	6.37E-04			1.77E-04	mg/kg-day	3.00E-03	mg/kg/day	5.90E-02
	Copper	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	3.70E-02	mg/kg/day	0.00E+00
	Iron	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Lead	0.815	mg/kg	6.37E-04			5.19E-04	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	2.40E-02	mg/kg/day	0.00E+00
	Manganese (in food)	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	0.497	mg/kg	6.37E-04			3.16E-04	mg/kg-day	3.00E-04	mg/kg/day	1.05E+00
	Selenium	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	6.60E-05	mg/kg/day	0.00E+00
	Vanadium	0.0715	mg/kg	6.37E-04			4.55E-05	mg/kg-day	1.00E-03	mg/kg/day	4.55E-02
	Zinc	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha-	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0.086	mg/kg	6.37E-04			5.47E-05	mg/kg-day	2.00E-05	mg/kg/day	2.74E+00
	DDD, p,p'-	0.0203	mg/kg	6.37E-04			1.29E-05	mg/kg-day	2.00E-03	mg/kg/day	6.46E-03
	DDE, p,p'-	0.0424	mg/kg	6.37E-04			2.70E-05	mg/kg-day	2.00E-03	mg/kg/day	1.35E-02
Total											3.96E+00
Grand Total											3.96E+00

Target organ across all exposure pathways: Central nervous system =	0.00E+00
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	0.00E+00
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	4.68E-02
Target organ across all exposure pathways: Gatrointestinal System =	5.90E-02
Target organ across all exposure pathways: Immune system =	3.79E+00
Target organ across all exposure pathways: Liver =	2.00E-02
Target organ across all exposure pathways: Whole body/growth =	4.55E-02

TABLE C-15 Grove Pond
Subsistance Adult
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Antimony	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Arsenic	0	mg/kg	1.04E-03			0.00E+00		1.50E+00	(mg/kg-day)-1	0.00E+00
	Barium	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Cadmium (in solid media)	0.0736	mg/kg	1.04E-03			7.65E-05		NC	NC	
	Cadmium (in water)								NC	NC	
	Chromium, total	0.278	mg/kg	1.04E-03			2.89E-04		NC	NC	
	Copper	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Iron	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Lead	0.815	mg/kg	1.04E-03			8.47E-04		NA	NA	
	Manganese (in sediment or water)	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Manganese (in food)	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Mercury	0.497	mg/kg	1.04E-03			5.17E-04		NC	NC	
	Selenium	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Thallium	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Vanadium	0.0715	mg/kg	1.04E-03			7.43E-05		NC	NC	
	Zinc	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Chloroform	0	mg/kg	1.04E-03			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	1.04E-03			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/kg	1.04E-03			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0	mg/kg	1.04E-03			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/kg	1.04E-03			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/kg	1.04E-03			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/kg	1.04E-03			0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/kg	1.04E-03			0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/kg	1.04E-03			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/kg	1.04E-03			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	1.04E-03			0.00E+00		1.40E-02	(mg/kg-day)-1	
	PCB 1254	0	mg/kg	1.04E-03			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0.086	mg/kg	1.04E-03			8.94E-05		2.00E+00	(mg/kg-day)-1	1.79E-04
	DDD, p,p'-	0.0203	mg/kg	1.04E-03			2.11E-05		2.40E-01	(mg/kg-day)-1	5.06E-06
	DDE, p,p'-	0.0424	mg/kg	1.04E-03			4.41E-05		3.40E-01	(mg/kg-day)-1	1.50E-05
Total											1.99E-04
Grand Total											1.99E-04

TABLE C-15 Grove Pond
Subsistance Adult
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	1.00E+00	mg/kg/day	0.00E+00
	Antimony	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	4.00E-04	mg/kg/day	0.00E+00
	Arsenic	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	3.00E-04	mg/kg/day	0.00E+00
	Barium	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	0.0736	mg/kg	2.43E-03			1.79E-04	mg/kg-day	1.00E-03	mg/kg/day	1.79E-01
	Cadmium (in water)			2.43E-03			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	0.278	mg/kg	2.43E-03			6.74E-04	mg/kg-day	3.00E-03	mg/kg/day	2.25E-01
	Copper	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	3.70E-02	mg/kg/day	0.00E+00
	Iron	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Lead	0.815	mg/kg	2.43E-03			1.98E-03	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	2.40E-02	mg/kg/day	0.00E+00
	Manganese (in food)	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	0.497	mg/kg	2.43E-03			1.21E-03	mg/kg-day	3.00E-04	mg/kg/day	4.02E+00
	Selenium	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	6.60E-05	mg/kg/day	0.00E+00
	Vanadium	0.0715	mg/kg	2.43E-03			1.73E-04	mg/kg-day	1.00E-03	mg/kg/day	1.73E-01
	Zinc	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha-	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0.086	mg/kg	2.43E-03			2.09E-04	mg/kg-day	2.00E-05	mg/kg/day	1.04E+01
	DDD, p,p'-	0.0203	mg/kg	2.43E-03			4.92E-05	mg/kg-day	2.00E-03	mg/kg/day	2.46E-02
	DDE, p,p'-	0.0424	mg/kg	2.43E-03			1.03E-04	mg/kg-day	2.00E-03	mg/kg/day	5.14E-02
Total											1.51E+01
Grand Total											1.51E+01

Target organ across all exposure pathways: Central nervous system =	0.00E+00
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	0.00E+00
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	1.79E-01
Target organ across all exposure pathways: Gatrointestinal System =	2.25E-01
Target organ across all exposure pathways: Immune system =	1.44E+01
Target organ across all exposure pathways: Liver =	7.60E-02
Target organ across all exposure pathways: Whole body/growth =	1.73E-01

TABLE C-16 Grove Pond
Subsistance Child
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC Value	EPC Units	Intake Factor		Other	Intake Value	Intake Units	CSF/Unit Risk Value	CSF/Unit Risk Units	Cancer Risk
Ingestion	Aluminum	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Antimony	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Arsenic	0	mg/kg	3.63E-04			0.00E+00		1.50E+00	(mg/kg-day)-1	0.00E+00
	Barium	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Cadmium (in solid media)	0.0736	mg/kg	3.63E-04			2.67E-05		NC	NC	
	Cadmium (in water)								NC	NC	
	Chromium, total	0.278	mg/kg	3.63E-04			1.01E-04		NC	NC	
	Copper	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Iron	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Lead	0.815	mg/kg	3.63E-04			2.96E-04		NA	NA	
	Manganese (in sediment or water)	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Manganese (in food)	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Mercury	0.497	mg/kg	3.63E-04			1.81E-04		NC	NC	
	Selenium	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Thallium	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Vanadium	0.0715	mg/kg	3.63E-04			2.60E-05		NC	NC	
	Zinc	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Chloroform	0	mg/kg	3.63E-04			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	3.63E-04			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/kg	3.63E-04			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0	mg/kg	3.63E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/kg	3.63E-04			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/kg	3.63E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/kg	3.63E-04			0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/kg	3.63E-04			0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/kg	3.63E-04			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/kg	3.63E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	3.63E-04			0.00E+00		1.40E-02	(mg/kg-day)-1	
	PCB 1254	0	mg/kg	3.63E-04			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0.086	mg/kg	3.63E-04			3.12E-05		2.00E+00	(mg/kg-day)-1	6.25E-05
	DDD, p,p'-	0.0203	mg/kg	3.63E-04			7.37E-06		2.40E-01	(mg/kg-day)-1	1.77E-06
	DDE, p,p'-	0.0424	mg/kg	3.63E-04			1.54E-05		3.40E-01	(mg/kg-day)-1	5.24E-06
Total											6.95E-05
Grand Total											6.95E-05

Note: the "Exposure Route" and "List of Chemicals of Potential Concern" header cells are printed over two lines (Exposure / Route; List of Chemicals of Potential / Concern). "EPC" is printed as a spanning header over Value and Units. "Cancer Risk Calculations" is printed as a spanning header over all of the columns from Intake Factor to Cancer Risk. "Intake" and "CSF/Unit Risk" are printed as spanning headers, each over its own Value and Units columns.

TABLE C-16 Grove Pond
Subsistance Child
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	1.00E+00	mg/kg/day	0.00E+00
	Antimony	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	4.00E-04	mg/kg/day	0.00E+00
	Arsenic	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	3.00E-04	mg/kg/day	0.00E+00
	Barium	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	0.0736	mg/kg	8.48E-04			6.24E-05	mg/kg-day	1.00E-03	mg/kg/day	6.24E-02
	Cadmium (in water)			8.48E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	0.278	mg/kg	8.48E-04			2.36E-04	mg/kg-day	3.00E-03	mg/kg/day	7.86E-02
	Copper	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	3.70E-02	mg/kg/day	0.00E+00
	Iron	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Lead	0.815	mg/kg	8.48E-04			6.91E-04	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	2.40E-02	mg/kg/day	0.00E+00
	Manganese (in food)	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	0.497	mg/kg	8.48E-04			4.21E-04	mg/kg-day	3.00E-04	mg/kg/day	1.40E+00
	Selenium	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	6.60E-05	mg/kg/day	0.00E+00
	Vanadium	0.0715	mg/kg	8.48E-04			6.06E-05	mg/kg-day	1.00E-03	mg/kg/day	6.06E-02
	Zinc	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha-	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0.086	mg/kg	8.48E-04			7.29E-05	mg/kg-day	2.00E-05	mg/kg/day	3.64E+00
	DDD, p,p'-	0.0203	mg/kg	8.48E-04			1.72E-05	mg/kg-day	2.00E-03	mg/kg/day	8.60E-03
	DDE, p,p'-	0.0424	mg/kg	8.48E-04			3.59E-05	mg/kg-day	2.00E-03	mg/kg/day	1.80E-02
Total											5.28E+00
Grand Total											5.28E+00

Target organ across all exposure pathways: Central nervous system =	0.00E+00
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	0.00E+00
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	6.24E-02
Target organ across all exposure pathways: Gatrointestinal System =	7.86E-02
Target organ across all exposure pathways: Immune system =	5.05E+00
Target organ across all exposure pathways: Liver =	2.66E-02
Target organ across all exposure pathways: Whole body/growth =	6.06E-02

TABLE C-17 Plow Shop Pond
Recreational Adult
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	9660	mg/kg	1.10E-07			1.06E-03		NC	NC	
	Antimony	17.1	mg/kg	1.10E-07			1.87E-06		NC	NC	
	Arsenic	930	mg/kg	1.10E-07			1.02E-04		1.50E+00	(mg/kg-day)-1	1.53E-04
	Barium	0	mg/kg	1.10E-07			0.00E+00		NC	NC	
	Cadmium (in solid media)	15.3	mg/kg	1.10E-07			1.68E-06		NC	NC	
	Cadmium (in water)								NC	NC	
	Chromium, total	12200	mg/kg	1.10E-07			1.34E-03		NC	NC	
	Copper	297	mg/kg	1.10E-07			3.26E-05		NC	NC	
	Iron	96300	mg/kg	1.10E-07			1.06E-02		NC	NC	
	Lead	229	mg/kg	1.10E-07			2.51E-05		NA	NA	
	Manganese (in sediment or water)	3020	mg/kg	1.10E-07			3.31E-04		NC	NC	
	Manganese (in food)	0	mg/kg	1.10E-07			0.00E+00		NC	NC	
	Mercury	34.7	mg/kg	1.10E-07			3.80E-06		NC	NC	
	Selenium	0	mg/kg	1.10E-07			0.00E+00		NC	NC	
	Thallium	13.4	mg/kg	1.10E-07			1.47E-06		NC	NC	
	Vanadium	35.6	mg/kg	1.10E-07			3.90E-06		NC	NC	
	Zinc	0	mg/kg	1.10E-07			0.00E+00		NC	NC	
	Chloroform	0	mg/kg	1.10E-07			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	1.10E-07			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/kg	1.10E-07			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	3.65	mg/kg	1.10E-07			4.00E-07		7.30E-01	(mg/kg-day)-1	2.92E-07
	Benzo(a)pyrene	4.67	mg/kg	1.10E-07			5.12E-07		7.30E+00	(mg/kg-day)-1	3.74E-06
	Benzo(b)fluoranthene	3.9	mg/kg	1.10E-07			4.28E-07		7.30E-01	(mg/kg-day)-1	3.12E-07
	Benzo(k)fluoranthene	1.44	mg/kg	1.10E-07			1.58E-07		7.30E-02	(mg/kg-day)-1	1.15E-08
	Chrysene	4.28	mg/kg	1.10E-07			4.69E-07		7.30E-03	(mg/kg-day)-1	3.43E-09
	Dibenz(ah)anthracene	0.96	mg/kg	1.10E-07			1.05E-07		7.30E+00	(mg/kg-day)-1	7.68E-07
	Indeno(1,2,3-cd)pyrene	3.66	mg/kg	1.10E-07			4.01E-07		7.30E-01	(mg/kg-day)-1	2.93E-07
	Naphthalene	0	mg/kg	1.10E-07			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	1.10E-07			0.00E+00		1.40E-02	(mg/kg-day)-1	0.00E+00
	PCB 1254	0	mg/kg	1.10E-07			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/kg	1.10E-07			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/kg	1.10E-07			0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0	mg/kg	1.10E-07			0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
Total											1.58E-04

TABLE C-17 Plow Shop Pond
Recreational Adult
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
				Intake Factor	DA event factor	ABSd	Intake		CSF/Unit Risk		Cancer Risk
Dermal	Aluminum	9660	mg/kg	4.93E+00	1.00E-06	---	#VALUE!		NC	NC	
	Antimony	17.1	mg/kg	4.93E+00	1.00E-06	---	#VALUE!		NC	NC	
	Arsenic	930	mg/kg	4.93E+00	1.00E-06	0.03	1.38E-04		1.50E+00	(mg/kg-day)-1	2.06E-04
	Barium	0	mg/kg	4.93E+00	1.00E-06	---	#VALUE!		NC	NC	
	Cadmium (in solid media)	15.3	mg/kg	4.93E+00	1.00E-06	0.001	7.55E-08		NC	NC	
	Cadmium (in water)					NA			NC	NC	
	Chromium, total	12200	mg/kg	4.93E+00	1.00E-06	---	#VALUE!		NC	NC	
	Copper	297	mg/kg	4.93E+00	1.00E-06	---	#VALUE!		NC	NC	
	Iron	96300	mg/kg	4.93E+00	1.00E-06	---	#VALUE!		NC	NC	
	Lead	229	mg/kg	4.93E+00	1.00E-06	---	#VALUE!		NA	NA	
	Manganese (in sediment or water)	3020	mg/kg	4.93E+00	1.00E-06	---	#VALUE!		NC	NC	
	Manganese (in food)	0	mg/kg	4.93E+00	1.00E-06	---	#VALUE!		NC	NC	
	Mercury	34.7	mg/kg	4.93E+00	1.00E-06	---	#VALUE!		NC	NC	
	Selenium	0	mg/kg	4.93E+00	1.00E-06	---	#VALUE!		NC	NC	
	Thallium	13.4	mg/kg	4.93E+00	1.00E-06	---	#VALUE!		NC	NC	
	Vanadium	35.6	mg/kg	4.93E+00	1.00E-06	---	#VALUE!		NC	NC	
	Zinc	0	mg/kg	4.93E+00	1.00E-06	---	#VALUE!		NC	NC	
	Chloroform	0	mg/kg	4.93E+00	1.00E-06	---	#VALUE!		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	4.93E+00	1.00E-06	0.04	0.00E+00		6.30E+00	(mg/kg-day)-1	
	Methylene chloride	0	mg/kg	4.93E+00	1.00E-06	---	#VALUE!		7.50E-03	(mg/kg-day)-1	
	Benz(a)anthracene	3.65	mg/kg	4.93E+00	1.00E-06	0.13	2.34E-06		7.30E-01	(mg/kg-day)-1	
	Benzo(a)pyrene	4.67	mg/kg	4.93E+00	1.00E-06	0.13	3.00E-06		7.30E+00	(mg/kg-day)-1	2.19E-05
	Benzo(b)fluoranthene	3.9	mg/kg	4.93E+00	1.00E-06	0.13	2.50E-06		7.30E-01	(mg/kg-day)-1	1.83E-06
	Benzo(k)fluoranthene	1.44	mg/kg	4.93E+00	1.00E-06	0.13	9.24E-07		7.30E-02	(mg/kg-day)-1	6.74E-08
	Chrysene	4.28	mg/kg	4.93E+00	1.00E-06	0.13	2.74E-06		7.30E-03	(mg/kg-day)-1	2.00E-08
	Dibenz(ah)anthracene	0.96	mg/kg	4.93E+00	1.00E-06	0.13	6.16E-07		7.30E+00	(mg/kg-day)-1	4.49E-06
	Indeno(1,2,3-cd)pyrene	3.66	mg/kg	4.93E+00	1.00E-06	0.13	2.35E-06		7.30E-01	(mg/kg-day)-1	1.71E-06
	Naphthalene	0	mg/kg	4.93E+00	1.00E-06	0.13	0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	4.93E+00	1.00E-06	0.1	0.00E+00		1.40E-02	(mg/kg-day)-1	
	PCB 1254	0	mg/kg	4.93E+00	1.00E-06	0.14	0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/kg	4.93E+00	1.00E-06	0.14	0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/kg	4.93E+00	1.00E-06	0.03	0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0	mg/kg	4.93E+00	1.00E-06	0.03	0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
											2.36E-04
Grand Total											3.95E-04

TABLE C-17 Plow Shop Pond
Recreational Adult
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	9660	mg/kg	2.56E-07			2.47E-03	mg/kg-day	1.00E+00	mg/kg/day	2.47E-03
	Antimony	17.1	mg/kg	2.56E-07			4.37E-06	mg/kg-day	4.00E-04	mg/kg/day	1.09E-02
	Arsenic	930	mg/kg	2.56E-07			2.38E-04	mg/kg-day	3.00E-04	mg/kg/day	7.93E-01
	Barium	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	15.3	mg/kg	2.56E-07			3.91E-06	mg/kg-day	1.00E-03	mg/kg/day	3.91E-03
	Cadmium (in water)			2.56E-07			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	12200	mg/kg	2.56E-07			3.12E-03	mg/kg-day	3.00E-03	mg/kg/day	1.04E+00
	Copper	297	mg/kg	2.56E-07			7.60E-05	mg/kg-day	3.70E-02	mg/kg/day	2.05E-03
	Iron	96300	mg/kg	2.56E-07			2.46E-02	mg/kg-day	3.00E-01	mg/kg/day	8.21E-02
	Lead	229	mg/kg	2.56E-07			5.86E-05	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	3020	mg/kg	2.56E-07			7.73E-04	mg/kg-day	2.40E-02	mg/kg/day	3.22E-02
	Manganese (in food)	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	34.7	mg/kg	2.56E-07			8.88E-06	mg/kg-day	3.00E-04	mg/kg/day	2.96E-02
	Selenium	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	13.4	mg/kg	2.56E-07			3.43E-06	mg/kg-day	6.60E-05	mg/kg/day	5.19E-02
	Vanadium	35.6	mg/kg	2.56E-07			9.11E-06	mg/kg-day	1.00E-03	mg/kg/day	9.11E-03
	Zinc	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha-	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	3.65	mg/kg	2.56E-07			9.34E-07	mg/kg-day	NA	NA	
	Benzo(a)pyrene	4.67	mg/kg	2.56E-07			1.19E-06	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.9	mg/kg	2.56E-07			9.98E-07	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.44	mg/kg	2.56E-07			3.68E-07	mg/kg-day	NA	NA	
	Chrysene	4.28	mg/kg	2.56E-07			1.09E-06	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0.96	mg/kg	2.56E-07			2.46E-07	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	3.66	mg/kg	2.56E-07			9.36E-07	mg/kg-day	NA	NA	
	Naphthalene	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	DDD, p,p'-	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
	DDE, p,p'-	0	mg/kg	2.56E-07			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
Total											2.06E+00

TABLE C-17 Plow Shop Pond
Recreational Adult
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC Value	EPC Units	Intake Factor	Other		Intake Value	Intake Units	RfD/RfC Value	RfD/RfC Units	Hazard Quotient
				Intake Factor	DA event factor	ABSd	Intake		RfD/RfC		Hazard Quotient
Dermal	Aluminum	9660	mg/kg	1.15E+01	1.00E-06	------	#VALUE!	mg/kg-day	1.00E+00	mg/kg-day	
	Antimony	17.1	mg/kg	1.15E+01	1.00E-06	------	#VALUE!	mg/kg-day	6.00E-05	mg/kg-day	
	Arsenic	930	mg/kg	1.15E+01	1.00E-06	3.00E-02	3.21E-04	mg/kg-day	3.00E-04	mg/kg-day	1.07E+00
	Barium	0	mg/kg	1.15E+01	1.00E-06	------	#VALUE!	mg/kg-day	1.40E-02	mg/kg-day	
	Cadmium (in solid media)	15.3	mg/kg	1.15E+01	1.00E-06	1.00E-03	1.76E-07	mg/kg-day	2.50E-05	mg/kg-day	7.04E-03
	Cadmium (in water)			1.15E+01	1.00E-06	NA	#VALUE!	mg/kg-day	2.50E-05	mg/kg-day	
	Chromium, total	12200	mg/kg	1.15E+01	1.00E-06	------	#VALUE!	mg/kg-day	3.90E-05	mg/kg-day	
	Copper	297	mg/kg	1.15E+01	1.00E-06	------	#VALUE!	mg/kg-day	3.70E-02	mg/kg-day	
	Iron	96300	mg/kg	1.15E+01	1.00E-06	------	#VALUE!	mg/kg-day	3.00E-01	mg/kg-day	
	Lead	229	mg/kg	1.15E+01	1.00E-06	------	#VALUE!	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	3020	mg/kg	1.15E+01	1.00E-06	------	#VALUE!	mg/kg-day	9.60E-04	mg/kg-day	
	Manganese (in food)	0	mg/kg	1.15E+01	1.00E-06	------	#VALUE!	mg/kg-day	5.60E-03	mg/kg-day	
	Mercury	34.7	mg/kg	1.15E+01	1.00E-06	------	#VALUE!	mg/kg-day	2.10E-05	mg/kg-day	
	Selenium	0	mg/kg	1.15E+01	1.00E-06	------	#VALUE!	mg/kg-day	5.00E-03	mg/kg-day	
	Thallium	13.4	mg/kg	1.15E+01	1.00E-06	------	#VALUE!	mg/kg-day	6.60E-05	mg/kg-day	
	Vanadium	35.6	mg/kg	1.15E+01	1.00E-06	------	#VALUE!	mg/kg-day	2.60E-05	mg/kg-day	
	Zinc	0	mg/kg	1.15E+01	1.00E-06	------	#VALUE!	mg/kg-day	3.00E-01	mg/kg-day	
	Chloroform	0	mg/kg	1.15E+01	1.00E-06	------	#VALUE!	mg/kg-day	1.00E-02	mg/kg-day	
	Hexachlorocyclohexane, alpha-	0	mg/kg	1.15E+01	1.00E-06	4.00E-02	0.00E+00	mg/kg-day	5.00E-04	mg/kg-day	0.00E+00
	Methylene chloride	0	mg/kg	1.15E+01	1.00E-06	------	#VALUE!	mg/kg-day	6.00E-02	mg/kg-day	
	Benz(a)anthracene	3.65	mg/kg	1.15E+01	1.00E-06	1.30E-01	5.46E-06	mg/kg-day	NA	NA	
	Benzo(a)pyrene	4.67	mg/kg	1.15E+01	1.00E-06	1.30E-01	6.99E-06	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.9	mg/kg	1.15E+01	1.00E-06	1.30E-01	5.84E-06	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.44	mg/kg	1.15E+01	1.00E-06	1.30E-01	2.15E-06	mg/kg-day	NA	NA	
	Chrysene	4.28	mg/kg	1.15E+01	1.00E-06	1.30E-01	6.40E-06	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0.96	mg/kg	1.15E+01	1.00E-06	1.30E-01	1.44E-06	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	3.66	mg/kg	1.15E+01	1.00E-06	1.30E-01	5.48E-06	mg/kg-day	NA	NA	
	Naphthalene	0	mg/kg	1.15E+01	1.00E-06	1.30E-01	0.00E+00	mg/kg-day	2.00E-02	mg/kg-day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/kg	1.15E+01	1.00E-06	1.00E-01	0.00E+00	mg/kg-day	2.00E-02	mg/kg-day	0.00E+00
	PCB 1254	0	mg/kg	1.15E+01	1.00E-06	1.40E-01	0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	PCBs, total	0	mg/kg	1.15E+01	1.00E-06	1.40E-01	0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	DDD, p,p'-	0	mg/kg	1.15E+01	1.00E-06	3.00E-02	0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
	DDE, p,p'-	0	mg/kg	1.15E+01	1.00E-06	3.00E-02	0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
Grand Total											1.08E+00 3.14E+00

Target organ across all exposure pathways: Central nervous system =	3.47E-02
Target organ across all exposure pathways: Blood =	1.09E-02
Target organ across all exposure pathways: Skin =	1.86E+00
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	1.10E-02
Target organ across all exposure pathways: Gatrointestinal System =	1.12E+00
Target organ across all exposure pathways: Immune system =	2.96E-02
Target organ across all exposure pathways: Liver =	5.19E-02
Target organ across all exposure pathways Whole body/growth =	9.11E-03

TABLE C-18 Plow Shop Pond
Recreational Adult
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Antimony	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Arsenic	0.151	mg/L	4.39E-05			6.62E-06		1.50E+00	(mg/kg-day)-1	9.93E-06
	Barium	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Cadmium (in solid media)	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Cadmium (in water)		mg/L						NC	NC	
	Chromium, total	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Copper	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Iron	5.97	mg/L	4.39E-05			2.62E-04		NC	NC	
	Lead	0.000379	mg/L	4.39E-05			1.66E-08		NA	NA	
	Manganese (in sediment or water)	0.148	mg/L	4.39E-05			6.49E-06		NC	NC	
	Manganese (in food)	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Mercury	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Selenium	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Thallium	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Vanadium	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Zinc	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Chloroform	0.00131	mg/L	4.39E-05			5.74E-08		NA	NA	
	Hexachlorocyclohexane, alpha-	5.24E-05	mg/L	4.39E-05			2.30E-09		6.30E+00	(mg/kg-day)-1	1.45E-08
	Methylene chloride	0.00804	mg/L	4.39E-05			3.53E-07		7.50E-03	(mg/kg-day)-1	2.64E-09
	Benz(a)anthracene	0	mg/L	4.39E-05			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/L	4.39E-05			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/L	4.39E-05			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/L	4.39E-05			0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/L	4.39E-05			0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/L	4.39E-05			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/L	4.39E-05			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/L	4.39E-05			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/L	4.39E-05			0.00E+00		1.40E-02	(mg/kg-day)-1	0.00E+00
	PCB 1254	0	mg/L	4.39E-05			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/L	4.39E-05			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/L	4.39E-05			0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0	mg/L	4.39E-05			0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
Total											9.95E-06

TABLE C-18 Plow Shop Pond
Recreational Adult
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC Value	EPC Units	Cancer Risk Calculations: Intake Factor		Other	Intake Value	Intake Units	CSF/Unit Risk Value	CSF/Unit Risk Units	Cancer Risk
				Intake Factor	DA event		Intake		CSF/Unit Risk		Cancer Risk
Dermal	Aluminum	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Antimony	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Arsenic	0.151	mg/L	4.91E+00	6.04E-07		2.96E-06		1.50E+00	(mg/kg-day)-1	4.45E-06
	Barium	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Cadmium (in solid media)	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Cadmium (in water)				0.00E+00		0.00E+00		NC	NC	
	Chromium, total	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Copper	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Iron	5.97	mg/L	4.91E+00	2.39E-05		1.17E-04		NC	NC	
	Lead	0.000379	mg/L	4.91E+00	1.52E-09		7.44E-09		NA	NA	
	Manganese (in sediment or water)	0.148	mg/L	4.91E+00	5.92E-07		2.90E-06		NC	NC	
	Manganese (in food)	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Mercury	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Selenium	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Thallium	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Vanadium	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Zinc	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Chloroform	0.00131	mg/L	4.91E+00	4.45E-08		2.19E-07		NA	NA	
	Hexachlorocyclohexane, alpha-	5.24E-05	mg/L	4.91E+00	6.81E-09		3.34E-08		6.30E+00	(mg/kg-day)-1	2.11E-07
	Methylene chloride	0.00804	mg/L	4.91E+00	1.31E-07		6.41E-07		7.50E-03	(mg/kg-day)-1	4.80E-09
	Benz(a)anthracene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/L	4.91E+00	0.00E+00		0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/L	4.91E+00	0.00E+00		0.00E+00		1.40E-02	(mg/kg-day)-1	0.00E+00
	PCB 1254	0	mg/L	4.91E+00	0.00E+00		0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/L	4.91E+00	0.00E+00		0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/L	4.91E+00	0.00E+00		0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0	mg/L	4.91E+00	0.00E+00		0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
Grand Total											4.66E-06 1.46E-05

TABLE C-18 Plow Shop Pond
Recreational Adult
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	1.00E+00	mg/kg/day	0.00E+00
	Antimony	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	4.00E-04	mg/kg/day	0.00E+00
	Arsenic	0.151	mg/L	1.02E-04			1.55E-05	mg/kg-day	3.00E-04	mg/kg/day	5.15E-02
	Barium	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	1.00E-03	mg/kg/day	0.00E+00
	Cadmium (in water)		mg/L	1.02E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	3.00E-03	mg/kg/day	0.00E+00
	Copper	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	3.70E-02	mg/kg/day	0.00E+00
	Iron	5.97	mg/L	1.02E-04			6.11E-04	mg/kg-day	3.00E-01	mg/kg/day	2.04E-03
	Lead	0.000379	mg/L	1.02E-04			3.88E-08	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0.148	mg/L	1.02E-04			1.51E-05	mg/kg-day	2.40E-02	mg/kg/day	6.31E-04
	Manganese (in food)	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	3.00E-04	mg/kg/day	0.00E+00
	Selenium	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	6.60E-05	mg/kg/day	0.00E+00
	Vanadium	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	1.00E-03	mg/kg/day	0.00E+00
	Zinc	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0.00131	mg/L	1.02E-04			1.34E-07	mg/kg-day	1.00E-02	mg/kg/day	1.34E-05
	Hexachlorocyclohexane, alpha-	5.24E-05	mg/L	1.02E-04			5.36E-09	mg/kg-day	5.00E-04	mg/kg/day	1.07E-05
	Methylene chloride	0.00804	mg/L	1.02E-04			8.23E-07	mg/kg-day	6.00E-02	mg/kg/day	1.37E-05
	Benz(a)anthracene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	DDD, p,p'-	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
	DDE, p,p'-	0	mg/L	1.02E-04			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
Total											5.42E-02

TABLE C-18 Plow Shop Pond
Recreational Adult
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC Value	EPC Units	Non-Cancer Hazard Calculations: Intake Factor	Other		Intake Value	Intake Units	RfD/RfC Value	RfD/RfC Units	Hazard Quotient
				Intake Factor	DA event		Intake		RfD/RfC		Hazard Quotient
Dermal	Aluminum	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	1.00E+00	mg/kg-day	
	Antimony	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	6.00E-05	mg/kg-day	
	Arsenic	0.151	mg/L	2.45E+01	6.04E-07		1.48E-05	mg/kg-day	3.00E-04	mg/kg-day	4.94E-02
	Barium	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	1.40E-02	mg/kg-day	0.00E+00
	Cadmium (in solid media)	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.50E-05	mg/kg-day	0.00E+00
	Cadmium (in water)			2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.50E-05	mg/kg-day	
	Chromium, total	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	3.90E-05	mg/kg-day	0.00E+00
	Copper	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	3.70E-02	mg/kg-day	
	Iron	5.97	mg/L	2.45E+01	2.39E-05		5.86E-04	mg/kg-day	3.00E-01	mg/kg-day	1.95E-03
	Lead	0.000379	mg/L	2.45E+01	1.52E-09		3.72E-08	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0.148	mg/L	2.45E+01	5.92E-07		1.45E-05	mg/kg-day	9.60E-04	mg/kg-day	1.51E-02
	Manganese (in food)	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	5.60E-03	mg/kg-day	
	Mercury	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.10E-05	mg/kg-day	
	Selenium	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	5.00E-03	mg/kg-day	
	Thallium	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	6.60E-05	mg/kg-day	
	Vanadium	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.60E-05	mg/kg-day	
	Zinc	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	3.00E-01	mg/kg-day	0.00E+00
	Chloroform	0.00131	mg/L	2.45E+01	4.45E-08		1.09E-06	mg/kg-day	1.00E-02	mg/kg-day	1.09E-04
	Hexachlorocyclohexane, alpha-	5.24E-05	mg/L	2.45E+01	6.81E-09		1.67E-07	mg/kg-day	5.00E-04	mg/kg-day	3.34E-04
	Methylene chloride	0.00804	mg/L	2.45E+01	1.31E-07		3.20E-06	mg/kg-day	6.00E-02	mg/kg-day	5.34E-05
	Benz(a)anthracene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-02	mg/kg-day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-02	mg/kg-day	0.00E+00
	PCB 1254	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	PCBs, total	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	DDD, p,p'-	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
	DDE, p,p'-	0	mg/L	2.45E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
											6.70E-02
Grand Total											1.21E-01

Target organ across all exposure pathways: Central nervous system =	1.58E-02
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	1.01E-01
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	3.45E-04
Target organ across all exposure pathways: Gatrointestinal System =	3.99E-03
Target organ across all exposure pathways: Immune system =	0.00E+00
Target organ across all exposure pathways: Liver =	1.90E-04
Target organ across all exposure pathways: Whole body/growth =	0.00E+00

TABLE C- 19 Plow Shop Pond
Recreational Adult
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC Value	EPC Units	Cancer Risk Calculations: Intake Factor		Other	Intake Value	Intake Units	CSF/Unit Risk Value	CSF/Unit Risk Units	Cancer Risk
Ingestion	Aluminum	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Antimony	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Arsenic	0.0796	mg/kg	1.56E-04			1.24E-05		1.50E+00	(mg/kg-day)-1	1.86E-05
	Barium	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Cadmium (in solid media)	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Cadmium (in water)								NC	NC	
	Chromium, total	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Copper	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Iron	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Lead	0	mg/kg	1.56E-04			0.00E+00		NA	NA	
	Manganese (in sediment or water)	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Manganese (in food)	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Mercury	2.59	mg/kg	1.56E-04			4.04E-04		NC	NC	
	Selenium	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Thallium	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Vanadium	0.449	mg/kg	1.56E-04			7.01E-05		NC	NC	
	Zinc	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Chloroform	0	mg/kg	1.56E-04			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	1.56E-04			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/kg	1.56E-04			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0	mg/kg	1.56E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/kg	1.56E-04			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/kg	1.56E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/kg	1.56E-04			0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/kg	1.56E-04			0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/kg	1.56E-04			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/kg	1.56E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/kg	1.56E-04			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	1.56E-04			0.00E+00		1.40E-02	(mg/kg-day)-1	
	PCB 1254	0	mg/kg	1.56E-04			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/kg	1.56E-04			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/kg	1.56E-04			0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0.0187	mg/kg	1.56E-04			2.92E-06		3.40E-01	(mg/kg-day)-1	9.93E-07
Total											1.96E-05
Grand Total											1.96E-05

TABLE C- 19 Plow Shop Pond
Recreational Adult
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	1.00E+00	mg/kg/day	0.00E+00
	Antimony	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	4.00E-04	mg/kg/day	0.00E+00
	Arsenic	0.0796	mg/kg	3.64E-04			2.90E-05	mg/kg-day	3.00E-04	mg/kg/day	9.67E-02
	Barium	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	1.00E-03	mg/kg/day	0.00E+00
	Cadmium (in water)			3.64E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	3.00E-03	mg/kg/day	0.00E+00
	Copper	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	3.70E-02	mg/kg/day	0.00E+00
	Iron	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Lead	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	2.40E-02	mg/kg/day	0.00E+00
	Manganese (in food)	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	2.59	mg/kg	3.64E-04			9.43E-04	mg/kg-day	3.00E-04	mg/kg/day	3.14E+00
	Selenium	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	6.60E-05	mg/kg/day	0.00E+00
	Vanadium	0.449	mg/kg	3.64E-04			1.64E-04	mg/kg-day	1.00E-03	mg/kg/day	1.64E-01
	Zinc	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha-	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	DDD, p,p'-	0	mg/kg	3.64E-04			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
	DDE, p,p'-	0.0187	mg/kg	3.64E-04			6.81E-06	mg/kg-day	2.00E-03	mg/kg/day	3.41E-03
Total											3.41E+00
Grand Total											3.41E+00

Target organ across all exposure pathways: Central nervous system =	0.00E+00
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	9.67E-02
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	0.00E+00
Target organ across all exposure pathways: Gatrointestinal System =	0.00E+00
Target organ across all exposure pathways: Immune system =	3.14E+00
Target organ across all exposure pathways: Liver =	3.41E-03
Target organ across all exposure pathways: Whole body/growth =	1.64E-01

TABLE C-20 Plow Shop Pond
Recreational Child
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	9660	mg/kg	2.05E-07			1.98E-03		NC	NC	
	Antimony	17.1	mg/kg	2.05E-07			3.50E-06		NC	NC	
	Arsenic	930	mg/kg	2.05E-07			1.90E-04		1.50E+00	(mg/kg-day)-1	2.85E-04
	Barium	0	mg/kg	2.05E-07			0.00E+00		NC	NC	
	Cadmium (in solid media)	15.3	mg/kg	2.05E-07			3.13E-06		NC	NC	
	Cadmium (in water)								NC	NC	
	Chromium, total	12200	mg/kg	2.05E-07			2.50E-03		NC	NC	
	Copper	297	mg/kg	2.05E-07			6.08E-05		NC	NC	
	Iron	96300	mg/kg	2.05E-07			1.97E-02		NC	NC	
	Lead	229	mg/kg	2.05E-07			4.69E-05		NA	NA	
	Manganese (in sediment or wa	3020	mg/kg	2.05E-07			6.18E-04		NC	NC	
	Manganese (in food)	0	mg/kg	2.05E-07			0.00E+00		NC	NC	
	Mercury	34.7	mg/kg	2.05E-07			7.10E-06		NC	NC	
	Selenium	0	mg/kg	2.05E-07			0.00E+00		NC	NC	
	Thallium	13.4	mg/kg	2.05E-07			2.74E-06		NC	NC	
	Vanadium	35.6	mg/kg	2.05E-07			7.29E-06		NC	NC	
	Zinc	0	mg/kg	2.05E-07			0.00E+00		NC	NC	
	Chloroform	0	mg/kg	2.05E-07			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha	0	mg/kg	2.05E-07			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/kg	2.05E-07			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	3.65	mg/kg	2.05E-07			7.47E-07		7.30E-01	(mg/kg-day)-1	5.45E-07
	Benzo(a)pyrene	4.67	mg/kg	2.05E-07			9.56E-07		7.30E+00	(mg/kg-day)-1	6.98E-06
	Benzo(b)fluoranthene	3.9	mg/kg	2.05E-07			7.98E-07		7.30E-01	(mg/kg-day)-1	5.83E-07
	Benzo(k)fluoranthene	1.44	mg/kg	2.05E-07			2.95E-07		7.30E-02	(mg/kg-day)-1	2.15E-08
	Chrysene	4.28	mg/kg	2.05E-07			8.76E-07		7.30E-03	(mg/kg-day)-1	6.39E-09
	Dibenz(ah)anthracene	0.96	mg/kg	2.05E-07			1.96E-07		7.30E+00	(mg/kg-day)-1	1.43E-06
	Indeno(1,2,3-cd)pyrene	3.66	mg/kg	2.05E-07			7.49E-07		7.30E-01	(mg/kg-day)-1	5.47E-07
	Naphthalene	0	mg/kg	2.05E-07			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	2.05E-07			0.00E+00		1.40E-02	(mg/kg-day)-1	0.00E+00
	PCB 1254	0	mg/kg	2.05E-07			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/kg	2.05E-07			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/kg	2.05E-07			0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0	mg/kg	2.05E-07			0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
Total											2.96E-04

TABLE C-20 Plow Shop Pond
Recreational Child
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
				Intake Factor	DA event factor	ABSd	Intake		CSF/Unit Risk		Cancer Risk
Dermal	Aluminum	9660	mg/kg	1.69E+00	1.00E-06	[illegible]	#VALUE!		NC	NC	
	Antimony	17.1	mg/kg	1.69E+00	1.00E-06	[illegible]	#VALUE!		NC	NC	
	Arsenic	930	mg/kg	1.69E+00	1.00E-06	0.03	4.71E-05		1.50E+00	(mg/kg-day)-1	7.07E-05
	Barium	0	mg/kg	1.69E+00	1.00E-06	[illegible]	#VALUE!		NC	NC	
	Cadmium (in solid media)	15.3	mg/kg	1.69E+00	1.00E-06	0.001	2.58E-08		NC	NC	
	Cadmium (in water)					NA			NC	NC	
	Chromium, total	12200	mg/kg	1.69E+00	1.00E-06	[illegible]	#VALUE!		NC	NC	
	Copper	297	mg/kg	1.69E+00	1.00E-06	[illegible]	#VALUE!		NC	NC	
	Iron	96300	mg/kg	1.69E+00	1.00E-06	[illegible]	#VALUE!		NC	NC	
	Lead	229	mg/kg	1.69E+00	1.00E-06	[illegible]	#VALUE!		NA	NA	
	Manganese (in sediment or wa	3020	mg/kg	1.69E+00	1.00E-06	[illegible]	#VALUE!		NC	NC	
	Manganese (in food)	0	mg/kg	1.69E+00	1.00E-06	[illegible]	#VALUE!		NC	NC	
	Mercury	34.7	mg/kg	1.69E+00	1.00E-06	[illegible]	#VALUE!		NC	NC	
	Selenium	0	mg/kg	1.69E+00	1.00E-06	[illegible]	#VALUE!		NC	NC	
	Thallium	13.4	mg/kg	1.69E+00	1.00E-06	[illegible]	#VALUE!		NC	NC	
	Vanadium	35.6	mg/kg	1.69E+00	1.00E-06	[illegible]	#VALUE!		NC	NC	
	Zinc	0	mg/kg	1.69E+00	1.00E-06	[illegible]	#VALUE!		NC	NC	
	Chloroform	0	mg/kg	1.69E+00	1.00E-06	[illegible]	#VALUE!		NA	NA	
	Hexachlorocyclohexane, alpha	0	mg/kg	1.69E+00	1.00E-06	0.04	0.00E+00		6.30E+00	(mg/kg-day)-1	
	Methylene chloride	0	mg/kg	1.69E+00	1.00E-06	[illegible]	#VALUE!		7.50E-03	(mg/kg-day)-1	
	Benz(a)anthracene	3.65	mg/kg	1.69E+00	1.00E-06	0.13	8.01E-07		7.30E-01	(mg/kg-day)-1	
	Benzo(a)pyrene	4.67	mg/kg	1.69E+00	1.00E-06	0.13	1.02E-06		7.30E+00	(mg/kg-day)-1	7.48E-06
	Benzo(b)fluoranthene	3.9	mg/kg	1.69E+00	1.00E-06	0.13	8.56E-07		7.30E-01	(mg/kg-day)-1	6.25E-07
	Benzo(k)fluoranthene	1.44	mg/kg	1.69E+00	1.00E-06	0.13	3.16E-07		7.30E-02	(mg/kg-day)-1	2.31E-08
	Chrysene	4.28	mg/kg	1.69E+00	1.00E-06	0.13	9.39E-07		7.30E-03	(mg/kg-day)-1	6.86E-09
	Dibenz(ah)anthracene	0.96	mg/kg	1.69E+00	1.00E-06	0.13	2.11E-07		7.30E+00	(mg/kg-day)-1	1.54E-06
	Indeno(1,2,3-cd)pyrene	3.66	mg/kg	1.69E+00	1.00E-06	0.13	8.03E-07		7.30E-01	(mg/kg-day)-1	5.86E-07
	Naphthalene	0	mg/kg	1.69E+00	1.00E-06	0.13	0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	1.69E+00	1.00E-06	0.1	0.00E+00		1.40E-02	(mg/kg-day)-1	
	PCB 1254	0	mg/kg	1.69E+00	1.00E-06	0.14	0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/kg	1.69E+00	1.00E-06	0.14	0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/kg	1.69E+00	1.00E-06	0.03	0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0	mg/kg	1.69E+00	1.00E-06	0.03	0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
											8.09E-05
Grand Total											3.77E-04

TABLE C-20 Plow Shop Pond
Recreational Child
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	9660	mg/kg	2.39E-06			2.31E-02	mg/kg-day	1.00E+00	mg/kg/day	2.31E-02
	Antimony	17.1	mg/kg	2.39E-06			4.08E-05	mg/kg-day	4.00E-04	mg/kg/day	1.02E-01
	Arsenic	930	mg/kg	2.39E-06			2.22E-03	mg/kg-day	3.00E-04	mg/kg/day	7.40E+00
	Barium	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	15.3	mg/kg	2.39E-06			3.65E-05	mg/kg-day	1.00E-03	mg/kg/day	3.65E-02
	Cadmium (in water)			2.39E-06			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	12200	mg/kg	2.39E-06			2.91E-02	mg/kg-day	3.00E-03	mg/kg/day	9.71E+00
	Copper	297	mg/kg	2.39E-06			7.09E-04	mg/kg-day	3.70E-02	mg/kg/day	1.92E-02
	Iron	96300	mg/kg	2.39E-06			2.30E-01	mg/kg-day	3.00E-01	mg/kg/day	7.66E-01
	Lead	229	mg/kg	2.39E-06			5.47E-04	mg/kg-day	NA	NA	
	Manganese (in sediment or wa	3020	mg/kg	2.39E-06			7.21E-03	mg/kg-day	2.40E-02	mg/kg/day	3.00E-01
	Manganese (in food)	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	34.7	mg/kg	2.39E-06			8.28E-05	mg/kg-day	3.00E-04	mg/kg/day	2.76E-01
	Selenium	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	13.4	mg/kg	2.39E-06			3.20E-05	mg/kg-day	6.60E-05	mg/kg/day	4.85E-01
	Vanadium	35.6	mg/kg	2.39E-06			8.50E-05	mg/kg-day	1.00E-03	mg/kg/day	8.50E-02
	Zinc	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	3.65	mg/kg	2.39E-06			8.71E-06	mg/kg-day	NA	NA	
	Benzo(a)pyrene	4.67	mg/kg	2.39E-06			1.11E-05	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.9	mg/kg	2.39E-06			9.31E-06	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.44	mg/kg	2.39E-06			3.44E-06	mg/kg-day	NA	NA	
	Chrysene	4.28	mg/kg	2.39E-06			1.02E-05	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0.96	mg/kg	2.39E-06			2.29E-06	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	3.66	mg/kg	2.39E-06			8.74E-06	mg/kg-day	NA	NA	
	Naphthalene	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	DDD, p,p'-	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
	DDE, p,p'-	0	mg/kg	2.39E-06			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
Total											1.92E+01

TABLE C-20 Plow Shop Pond
Recreational Child
Sediment

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
				Intake Factor	DA event factor	ABSd	Intake		RfD/RfC		Hazard Quotient
Dermal	Aluminum	9660	mg/kg	1.97E+01	1.00E-06	----------	#VALUE!	mg/kg-day	1.00E+00	mg/kg-day	
	Antimony	17.1	mg/kg	1.97E+01	1.00E-06	----------	#VALUE!	mg/kg-day	6.00E-05	mg/kg-day	
	Arsenic	930	mg/kg	1.97E+01	1.00E-06	3.00E-02	5.50E-04	mg/kg-day	3.00E-04	mg/kg-day	1.83E+00
	Barium	0	mg/kg	1.97E+01	1.00E-06	----------	#VALUE!	mg/kg-day	1.40E-02	mg/kg-day	
	Cadmium (in solid media)	15.3	mg/kg	1.97E+01	1.00E-06	1.00E-03	3.01E-07	mg/kg-day	2.50E-05	mg/kg-day	1.21E-02
	Cadmium (in water)			1.97E+01	1.00E-06	NA	#VALUE!	mg/kg-day	2.50E-05	mg/kg-day	
	Chromium, total	12200	mg/kg	1.97E+01	1.00E-06	----------	#VALUE!	mg/kg-day	3.90E-05	mg/kg-day	
	Copper	297	mg/kg	1.97E+01	1.00E-06	----------	#VALUE!	mg/kg-day	3.70E-02	mg/kg-day	
	Iron	96300	mg/kg	1.97E+01	1.00E-06	----------	#VALUE!	mg/kg-day	3.00E-01	mg/kg-day	
	Lead	229	mg/kg	1.97E+01	1.00E-06	----------	#VALUE!	mg/kg-day	NA	NA	
	Manganese (in sediment or wa	3020	mg/kg	1.97E+01	1.00E-06	----------	#VALUE!	mg/kg-day	9.60E-04	mg/kg-day	
	Manganese (in food)	0	mg/kg	1.97E+01	1.00E-06	----------	#VALUE!	mg/kg-day	5.60E-03	mg/kg-day	
	Mercury	34.7	mg/kg	1.97E+01	1.00E-06	----------	#VALUE!	mg/kg-day	2.10E-05	mg/kg-day	
	Selenium	0	mg/kg	1.97E+01	1.00E-06	----------	#VALUE!	mg/kg-day	5.00E-03	mg/kg-day	
	Thallium	13.4	mg/kg	1.97E+01	1.00E-06	----------	#VALUE!	mg/kg-day	6.60E-05	mg/kg-day	
	Vanadium	35.6	mg/kg	1.97E+01	1.00E-06	----------	#VALUE!	mg/kg-day	2.60E-05	mg/kg-day	
	Zinc	0	mg/kg	1.97E+01	1.00E-06	----------	#VALUE!	mg/kg-day	3.00E-01	mg/kg-day	
	Chloroform	0	mg/kg	1.97E+01	1.00E-06	----------	#VALUE!	mg/kg-day	1.00E-02	mg/kg-day	
	Hexachlorocyclohexane, alpha	0	mg/kg	1.97E+01	1.00E-06	4.00E-02	0.00E+00	mg/kg-day	5.00E-04	mg/kg-day	0.00E+00
	Methylene chloride	0	mg/kg	1.97E+01	1.00E-06	----------	#VALUE!	mg/kg-day	6.00E-02	mg/kg-day	
	Benz(a)anthracene	3.65	mg/kg	1.97E+01	1.00E-06	1.30E-01	9.35E-06	mg/kg-day	NA	NA	
	Benzo(a)pyrene	4.67	mg/kg	1.97E+01	1.00E-06	1.30E-01	1.20E-05	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.9	mg/kg	1.97E+01	1.00E-06	1.30E-01	9.99E-06	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.44	mg/kg	1.97E+01	1.00E-06	1.30E-01	3.69E-06	mg/kg-day	NA	NA	
	Chrysene	4.28	mg/kg	1.97E+01	1.00E-06	1.30E-01	1.10E-05	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0.96	mg/kg	1.97E+01	1.00E-06	1.30E-01	2.46E-06	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	3.66	mg/kg	1.97E+01	1.00E-06	1.30E-01	9.37E-06	mg/kg-day	NA	NA	
	Naphthalene	0	mg/kg	1.97E+01	1.00E-06	1.30E-01	0.00E+00	mg/kg-day	2.00E-02	mg/kg-day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/kg	1.97E+01	1.00E-06	1.00E-01	0.00E+00	mg/kg-day	2.00E-02	mg/kg-day	0.00E+00
	PCB 1254	0	mg/kg	1.97E+01	1.00E-06	1.40E-01	0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	PCBs, total	0	mg/kg	1.97E+01	1.00E-06	1.40E-01	0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	DDD, p,p'-	0	mg/kg	1.97E+01	1.00E-06	3.00E-02	0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
	DDE, p,p'-	0	mg/kg	1.97E+01	1.00E-06	3.00E-02	0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
											1.84E+00
Grand Total											2.10E+01

Target organ across all exposure pathways: Central nervous system =	3.23E-01
Target organ across all exposure pathways: Blood =	1.02E-01
Target organ across all exposure pathways: Skin =	9.23E+00
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	4.86E-02
Target organ across all exposure pathways: Gatrointestinal System =	1.05E+01
Target organ across all exposure pathways: Immune system =	2.76E-01
Target organ across all exposure pathways: Liver =	4.85E-01
Target organ across all exposure pathways: Whole body/growth =	8.50E-02

TABLE C-21 Plow Shop Pond
Recreational Child
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Antimony	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Arsenic	0.151	mg/L	2.05E-04			3.09E-05		1.50E+00	(mg/kg-day)-1	4.64E-05
	Barium	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Cadmium (in solid media)	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Cadmium (in water)		mg/L						NC	NC	
	Chromium, total	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Copper	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Iron	5.97	mg/L	2.05E-04			1.22E-03		NC	NC	
	Lead	0.000379	mg/L	2.05E-04			7.76E-08		NA	NA	
	Manganese (in sediment or water)	0.148	mg/L	2.05E-04			3.03E-05		NC	NC	
	Manganese (in food)	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Mercury	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Selenium	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Thallium	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Vanadium	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Zinc	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Chloroform	0.00131	mg/L	2.05E-04			2.68E-07		NA	NA	
	Hexachlorocyclohexane, alpha-	5.24E-05	mg/L	2.05E-04			1.07E-08		6.30E+00	(mg/kg-day)-1	6.76E-08
	Methylene chloride	0.00804	mg/L	2.05E-04			1.65E-06		7.50E-03	(mg/kg-day)-1	1.23E-08
	Benz(a)anthracene	0	mg/L	2.05E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/L	2.05E-04			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/L	2.05E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/L	2.05E-04			0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/L	2.05E-04			0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/L	2.05E-04			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/L	2.05E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/L	2.05E-04			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/L	2.05E-04			0.00E+00		1.40E-02	(mg/kg-day)-1	0.00E+00
	PCB 1254	0	mg/L	2.05E-04			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/L	2.05E-04			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/L	2.05E-04			0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0	mg/L	2.05E-04			0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
Total											4.64E-05

TABLE C-21 Plow Shop Pond
Recreational Child
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC Value	EPC Units	Cancer Risk Calculations: Intake Factor		Other	Intake Value	Intake Units	CSF/Unit Risk Value	CSF/Unit Risk Units	Cancer Risk
				Intake Factor	DA event		Intake		CSF/Unit Risk		Cancer Risk
Dermal	Aluminum	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Antimony	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Arsenic	0.151	mg/L	1.68E+00	6.04E-07		1.01E-06		1.50E+00	(mg/kg-day)-1	1.52E-06
	Barium	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Cadmium (in solid media)	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Cadmium (in water)				0.00E+00		0.00E+00		NC	NC	
	Chromium, total	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Copper	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Iron	5.97	mg/L	1.68E+00	2.39E-05		4.01E-05		NC	NC	
	Lead	0.000379	mg/L	1.68E+00	1.52E-09		2.55E-09		NA	NA	
	Manganese (in sediment or water)	0.148	mg/L	1.68E+00	5.92E-07		9.94E-07		NC	NC	
	Manganese (in food)	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Mercury	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Selenium	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Thallium	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Vanadium	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Zinc	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Chloroform	0.00131	mg/L	1.68E+00	4.45E-08		7.48E-08		NA	NA	
	Hexachlorocyclohexane, alpha-	5.24E-05	mg/L	1.68E+00	6.81E-09		1.14E-08		6.30E+00	(mg/kg-day)-1	7.21E-08
	Methylene chloride	0.00804	mg/L	1.68E+00	1.31E-07		2.19E-07		7.50E-03	(mg/kg-day)-1	1.64E-09
	Benz(a)anthracene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/L	1.68E+00	0.00E+00		0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/L	1.68E+00	0.00E+00		0.00E+00		1.40E-02	(mg/kg-day)-1	0.00E+00
	PCB 1254	0	mg/L	1.68E+00	0.00E+00		0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/L	1.68E+00	0.00E+00		0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/L	1.68E+00	0.00E+00		0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0	mg/L	1.68E+00	0.00E+00		0.00E+00		3.40E-01	(mg/kg-day)-1	0.00E+00
											1.59E-06
Grand Total											4.80E-05

TABLE C-21 Plow Shop Pond
Recreational Child
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	1.00E+00	mg/kg/day	0.00E+00
	Antimony	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	4.00E-04	mg/kg/day	0.00E+00
	Arsenic	0.151	mg/L	2.39E-03			3.61E-04	mg/kg-day	3.00E-04	mg/kg/day	1.20E+00
	Barium	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	1.00E-03	mg/kg/day	0.00E+00
	Cadmium (in water)		mg/L	2.39E-03			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	3.00E-03	mg/kg/day	0.00E+00
	Copper	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	3.70E-02	mg/kg/day	0.00E+00
	Iron	5.97	mg/L	2.39E-03			1.43E-02	mg/kg-day	3.00E-01	mg/kg/day	4.75E-02
	Lead	0.000379	mg/L	2.39E-03			9.05E-07	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0.148	mg/L	2.39E-03			3.53E-04	mg/kg-day	2.40E-02	mg/kg/day	1.47E-02
	Manganese (in food)	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	3.00E-04	mg/kg/day	0.00E+00
	Selenium	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	6.60E-05	mg/kg/day	0.00E+00
	Vanadium	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	1.00E-03	mg/kg/day	0.00E+00
	Zinc	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0.00131	mg/L	2.39E-03			3.13E-06	mg/kg-day	1.00E-02	mg/kg/day	3.13E-04
	Hexachlorocyclohexane, alpha-	5.24E-05	mg/L	2.39E-03			1.25E-07	mg/kg-day	5.00E-04	mg/kg/day	2.50E-04
	Methylene chloride	0.00804	mg/L	2.39E-03			1.92E-05	mg/kg-day	6.00E-02	mg/kg/day	3.20E-04
	Benz(a)anthracene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	DDD, p,p'-	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
	DDE, p,p'-	0	mg/L	2.39E-03			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
Total											1.26E+00

TABLE C-21 Plow Shop Pond
Recreational Child
Surface Water

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
				Intake Factor	DA event		Intake		RfD/RfC		Hazard Quotient
Dermal	Aluminum	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	1.00E+00	mg/kg-day	
	Antimony	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	6.00E-05	mg/kg-day	
	Arsenic	0.151	mg/L	1.96E+01	6.04E-07		1.18E-05	mg/kg-day	3.00E-04	mg/kg-day	3.94E-02
	Barium	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	1.40E-02	mg/kg-day	0.00E+00
	Cadmium (in solid media)	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.50E-05	mg/kg-day	0.00E+00
	Cadmium (in water)			1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.50E-05	mg/kg-day	
	Chromium, total	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	3.90E-05	mg/kg-day	0.00E+00
	Copper	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	3.70E-02	mg/kg-day	
	Iron	5.97	mg/L	1.96E+01	2.39E-05		4.68E-04	mg/kg-day	3.00E-01	mg/kg-day	1.56E-03
	Lead	0.000379	mg/L	1.96E+01	1.52E-09		2.97E-08	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0.148	mg/L	1.96E+01	5.92E-07		1.16E-05	mg/kg-day	9.60E-04	mg/kg-day	1.21E-02
	Manganese (in food)	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	5.60E-03	mg/kg-day	
	Mercury	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.10E-05	mg/kg-day	
	Selenium	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	5.00E-03	mg/kg-day	
	Thallium	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	6.60E-05	mg/kg-day	
	Vanadium	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.60E-05	mg/kg-day	
	Zinc	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	3.00E-01	mg/kg-day	0.00E+00
	Chloroform	0.00131	mg/L	1.96E+01	4.45E-08		8.72E-07	mg/kg-day	1.00E-02	mg/kg-day	8.72E-05
	Hexachlorocyclohexane, alpha-	5.24E-05	mg/L	1.96E+01	6.81E-09		1.33E-07	mg/kg-day	5.00E-04	mg/kg-day	2.67E-04
	Methylene chloride	0.00804	mg/L	1.96E+01	1.31E-07		2.56E-06	mg/kg-day	6.00E-02	mg/kg-day	4.26E-05
	Benz(a)anthracene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-02	mg/kg-day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-02	mg/kg-day	0.00E+00
	PCB 1254	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	PCBs, total	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-05	mg/kg-day	0.00E+00
	DDD, p,p'-	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
	DDE, p,p'-	0	mg/L	1.96E+01	0.00E+00		0.00E+00	mg/kg-day	2.00E-03	mg/kg-day	0.00E+00
											5.35E-02
Grand Total											1.32E+00

Target organ across all exposure pathways: Central nervous system =	2.68E-02
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	1.24E+00
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	5.17E-04
Target organ across all exposure pathways: Gatrointestinal System =	4.91E-02
Target organ across all exposure pathways: Immune system =	0.00E+00
Target organ across all exposure pathways: Liver =	7.63E-04
Target organ across all exposure pathways: Whole body/growth =	0.00E+00

TABLE C-22 PLOW SHOP POND
Recreational Child
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Antimony	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Arsenic	0.0796	mg/kg	5.46E-05			4.34E-06		1.50E+00	(mg/kg-day)-1	6.51E-06
	Barium	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Cadmium (in solid media)	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Cadmium (in water)								NC	NC	
	Chromium, total	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Copper	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Iron	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Lead	0	mg/kg	5.46E-05			0.00E+00		NA	NA	
	Manganese (in sediment or water)	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Manganese (in food)	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Mercury	2.59	mg/kg	5.46E-05			1.41E-04		NC	NC	
	Selenium	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Thallium	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Vanadium	0.449	mg/kg	5.46E-05			2.45E-05		NC	NC	
	Zinc	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Chloroform	0	mg/kg	5.46E-05			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	5.46E-05			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/kg	5.46E-05			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0	mg/kg	5.46E-05			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/kg	5.46E-05			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/kg	5.46E-05			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/kg	5.46E-05			0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/kg	5.46E-05			0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/kg	5.46E-05			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/kg	5.46E-05			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/kg	5.46E-05			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	5.46E-05			0.00E+00		1.40E-02	(mg/kg-day)-1	
	PCB 1254	0	mg/kg	5.46E-05			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/kg	5.46E-05			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/kg	5.46E-05			0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0.0187	mg/kg	5.46E-05			1.02E-06		3.40E-01	(mg/kg-day)-1	3.47E-07
Total											6.86E-06
Grand Total											6.86E-06

TABLE C-22 PLOW SHOP POND
Recreational Child
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC Value	EPC Units	Intake Factor	Other		Intake Value	Intake Units	RfD/RfC Value	RfD/RfC Units	Hazard Quotient
Ingestion	Aluminum	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	1.00E+00	mg/kg/day	0.00E+00
	Antimony	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	4.00E-04	mg/kg/day	0.00E+00
	Arsenic	0.0796	mg/kg	6.37E-04			5.07E-05	mg/kg-day	3.00E-04	mg/kg/day	1.69E-01
	Barium	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	1.00E-03	mg/kg/day	0.00E+00
	Cadmium (in water)			6.37E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	3.00E-03	mg/kg/day	0.00E+00
	Copper	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	3.70E-02	mg/kg/day	0.00E+00
	Iron	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Lead	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	2.40E-02	mg/kg/day	0.00E+00
	Manganese (in food)	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	2.59	mg/kg	6.37E-04			1.65E-03	mg/kg-day	3.00E-04	mg/kg/day	5.50E+00
	Selenium	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	6.60E-05	mg/kg/day	0.00E+00
	Vanadium	0.449	mg/kg	6.37E-04			2.86E-04	mg/kg-day	1.00E-03	mg/kg/day	2.86E-01
	Zinc	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha-	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	DDD, p,p'-	0	mg/kg	6.37E-04			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
	DDE, p,p'-	0.0187	mg/kg	6.37E-04			1.19E-05	mg/kg-day	2.00E-03	mg/kg/day	5.95E-03
Total											5.96E+00
Grand Total											5.96E+00

Non-Cancer Hazard Calculations

Target organ across all exposure pathways: Central nervous system =	0.00E+00
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	1.69E-01
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	0.00E+00
Target organ across all exposure pathways: Gatrointestinal System =	0.00E+00
Target organ across all exposure pathways: Immune system =	5.50E+00
Target organ across all exposure pathways: Liver =	5.95E-03
Target organ across all exposure pathways: Whole body/growth =	2.86E-01

TABLE C-23 Plow Shop Pond
Subsistance Adult
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC		Cancer Risk Calculations							
		Value	Units	Intake Factor		Other	Intake		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Antimony	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Arsenic	0.0796	mg/kg	1.04E-03			8.27E-05		1.50E+00	(mg/kg-day)-1	1.24E-04
	Barium	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Cadmium (in solid media)	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Cadmium (in water)								NC	NC	
	Chromium, total	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Copper	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Iron	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Lead	0	mg/kg	1.04E-03			0.00E+00		NA	NA	
	Manganese (in sediment or water)	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Manganese (in food)	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Mercury	2.59	mg/kg	1.04E-03			2.69E-03		NC	NC	
	Selenium	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Thallium	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Vanadium	0.449	mg/kg	1.04E-03			4.67E-04		NC	NC	
	Zinc	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Chloroform	0	mg/kg	1.04E-03			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	1.04E-03			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/kg	1.04E-03			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0	mg/kg	1.04E-03			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/kg	1.04E-03			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/kg	1.04E-03			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/kg	1.04E-03			0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/kg	1.04E-03			0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/kg	1.04E-03			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/kg	1.04E-03			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/kg	1.04E-03			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	1.04E-03			0.00E+00		1.40E-02	(mg/kg-day)-1	
	PCB 1254	0	mg/kg	1.04E-03			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/kg	1.04E-03			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/kg	1.04E-03			0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0.0187	mg/kg	1.04E-03			1.94E-05		3.40E-01	(mg/kg-day)-1	6.61E-06
Total											1.31E-04
Grand Total											1.31E-04

TABLE C-23 Plow Shop Pond
Subsistance Adult
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	1.00E+00	mg/kg/day	0.00E+00
	Antimony	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	4.00E-04	mg/kg/day	0.00E+00
	Arsenic	0.0796	mg/kg	2.43E-03			1.93E-04	mg/kg-day	3.00E-04	mg/kg/day	6.44E-01
	Barium	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	1.00E-03	mg/kg/day	0.00E+00
	Cadmium (in water)			2.43E-03			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	3.00E-03	mg/kg/day	0.00E+00
	Copper	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	3.70E-02	mg/kg/day	0.00E+00
	Iron	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Lead	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	2.40E-02	mg/kg/day	0.00E+00
	Manganese (in food)	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	2.59	mg/kg	2.43E-03			6.28E-03	mg/kg-day	3.00E-04	mg/kg/day	2.09E+01
	Selenium	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	6.60E-05	mg/kg/day	0.00E+00
	Vanadium	0.449	mg/kg	2.43E-03			1.09E-03	mg/kg-day	1.00E-03	mg/kg/day	1.09E+00
	Zinc	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha-	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	DDD, p,p'-	0	mg/kg	2.43E-03			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
	DDE, p,p'-	0.0187	mg/kg	2.43E-03			4.54E-05	mg/kg-day	2.00E-03	mg/kg/day	2.27E-02
Total											2.27E+01
Grand Total											2.27E+01

Target organ across all exposure pathways: Central nervous system =	0.00E+00
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	6.44E-01
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	0.00E+00
Target organ across all exposure pathways: Gatrointestinal System =	0.00E+00
Target organ across all exposure pathways: Immune system =	2.09E+01
Target organ across all exposure pathways: Liver =	2.27E-02
Target organ across all exposure pathways: Whole body/growth =	1.09E+00

TABLE C- 24Plow Shop Pond
Subsistance Child
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC Value	EPC Units	Cancer Risk Calculations: Intake Factor		Other	Intake Value	Intake Units	CSF/Unit Risk Value	CSF/Unit Risk Units	Cancer Risk
Ingestion	Aluminum	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Antimony	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Arsenic	0.0796	mg/kg	3.63E-04			2.89E-05		1.50E+00	(mg/kg-day)-1	4.34E-05
	Barium	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Cadmium (in solid media)	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Cadmium (in water)								NC	NC	
	Chromium, total	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Copper	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Iron	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Lead	0	mg/kg	3.63E-04			0.00E+00		NA	NA	
	Manganese (in sediment or water)	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Manganese (in food)	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Mercury	2.59	mg/kg	3.63E-04			9.41E-04		NC	NC	
	Selenium	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Thallium	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Vanadium	0.449	mg/kg	3.63E-04			1.63E-04		NC	NC	
	Zinc	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Chloroform	0	mg/kg	3.63E-04			0.00E+00		NA	NA	
	Hexachlorocyclohexane, alpha-	0	mg/kg	3.63E-04			0.00E+00		6.30E+00	(mg/kg-day)-1	0.00E+00
	Methylene chloride	0	mg/kg	3.63E-04			0.00E+00		7.50E-03	(mg/kg-day)-1	0.00E+00
	Benz(a)anthracene	0	mg/kg	3.63E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(a)pyrene	0	mg/kg	3.63E-04			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Benzo(b)fluoranthene	0	mg/kg	3.63E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Benzo(k)fluoranthene	0	mg/kg	3.63E-04			0.00E+00		7.30E-02	(mg/kg-day)-1	0.00E+00
	Chrysene	0	mg/kg	3.63E-04			0.00E+00		7.30E-03	(mg/kg-day)-1	0.00E+00
	Dibenz(ah)anthracene	0	mg/kg	3.63E-04			0.00E+00		7.30E+00	(mg/kg-day)-1	0.00E+00
	Indeno(1,2,3-cd)pyrene	0	mg/kg	3.63E-04			0.00E+00		7.30E-01	(mg/kg-day)-1	0.00E+00
	Naphthalene	0	mg/kg	3.63E-04			0.00E+00		NC	NC	
	Bis(2-ethylhexyl) phthalate	0	mg/kg	3.63E-04			0.00E+00		1.40E-02	(mg/kg-day)-1	
	PCB 1254	0	mg/kg	3.63E-04			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	PCBs, total	0	mg/kg	3.63E-04			0.00E+00		2.00E+00	(mg/kg-day)-1	0.00E+00
	DDD, p,p'-	0	mg/kg	3.63E-04			0.00E+00		2.40E-01	(mg/kg-day)-1	0.00E+00
	DDE, p,p'-	0.0187	mg/kg	3.63E-04			6.79E-06		3.40E-01	(mg/kg-day)-1	2.31E-06
Total											4.57E-05
Grand Total											4.57E-05

TABLE C- 24Plow Shop Pond
Subsistance Child
Fish

Exposure Route	List of Chemicals of Potential Concern	EPC		Non-Cancer Hazard Calculations							
		Value	Units	Intake Factor	Other		Intake		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
Ingestion	Aluminum	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	1.00E+00	mg/kg/day	0.00E+00
	Antimony	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	4.00E-04	mg/kg/day	0.00E+00
	Arsenic	0.0796	mg/kg	8.48E-04			6.75E-05	mg/kg-day	3.00E-04	mg/kg/day	2.25E-01
	Barium	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	2.00E-01	mg/kg/day	0.00E+00
	Cadmium (in solid media)	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	1.00E-03	mg/kg/day	0.00E+00
	Cadmium (in water)			8.48E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Chromium, total	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	3.00E-03	mg/kg/day	0.00E+00
	Copper	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	3.70E-02	mg/kg/day	0.00E+00
	Iron	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Lead	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Manganese (in sediment or water)	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	2.40E-02	mg/kg/day	0.00E+00
	Manganese (in food)	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	1.40E-01	mg/kg/day	0.00E+00
	Mercury	2.59	mg/kg	8.48E-04			2.20E-03	mg/kg-day	3.00E-04	mg/kg/day	7.32E+00
	Selenium	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	5.00E-03	mg/kg/day	0.00E+00
	Thallium	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	6.60E-05	mg/kg/day	0.00E+00
	Vanadium	0.449	mg/kg	8.48E-04			3.81E-04	mg/kg-day	1.00E-03	mg/kg/day	3.81E-01
	Zinc	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	3.00E-01	mg/kg/day	0.00E+00
	Chloroform	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	1.00E-02	mg/kg/day	0.00E+00
	Hexachlorocyclohexane, alpha-	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	5.00E-04	mg/kg/day	0.00E+00
	Methylene chloride	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	6.00E-02	mg/kg/day	0.00E+00
	Benz(a)anthracene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(a)pyrene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Chrysene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Dibenz(ah)anthracene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	NA	NA	
	Naphthalene	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	Bis(2-ethylhexyl) phthalate	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	2.00E-02	mg/kg/day	0.00E+00
	PCB 1254	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	PCBs, total	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	2.00E-05	mg/kg/day	0.00E+00
	DDD, p,p'-	0	mg/kg	8.48E-04			0.00E+00	mg/kg-day	2.00E-03	mg/kg/day	0.00E+00
	DDE, p,p'-	0.0187	mg/kg	8.48E-04			1.59E-05	mg/kg-day	2.00E-03	mg/kg/day	7.93E-03
Total											7.93E+00
Grand Total											7.93E+00

Target organ across all exposure pathways: Central nervous system =	0.00E+00
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	2.25E-01
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	0.00E+00
Target organ across all exposure pathways: Gatrointestinal System =	0.00E+00
Target organ across all exposure pathways: Immune system =	7.32E+00
Target organ across all exposure pathways: Liver =	7.93E-03
Target organ across all exposure pathways: Whole body/growth =	3.81E-01

TABLE C-25

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Sediment	Near-shore Grove Pond Sediment	Aluminum	0.00E+00		0.00E+00	0.00E+00		5.19E-03		0.00E+00	5.19E-03
			Antimony	0.00E+00		0.00E+00	0.00E+00		7.61E-03		0.00E+00	7.61E-03
			Arsenic	2.60E-05		3.51E-05	6.11E-05		1.35E-01		1.82E-01	3.17E-01
			Barium	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00		1.24E-02		2.24E-02	3.48E-02
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Chromium, total	0.00E+00		0.00E+00	0.00E+00		1.23E-02		0.00E+00	1.23E-02
			Copper	0.00E+00		0.00E+00	0.00E+00		5.50E-03		0.00E+00	6.50E-03
			Iron	0.00E+00		0.00E+00	0.00E+00		1.63E-02		0.00E+00	1.63E-02
			Lead	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00		7.68E-03		0.00E+00	7.68E-03
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Mercury	0.00E+00		0.00E+00	0.00E+00		8.05E-02		0.00E+00	8.05E-02
			Selenium	0.00E+00		0.00E+00	0.00E+00		4.99E-04		0.00E+00	4.99E-04
			Thallium	0.00E+00		0.00E+00	0.00E+00		1.02E-01		0.00E+00	1.02E-01
			Vanadium	0.00E+00		0.00E+00	0.00E+00		1.09E-02		0.00E+00	1.09E-02
			Zinc	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Chloroform	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Hexachlorocyclohexane, alpha-	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Methylene chloride	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Benz(a)anthracene	5.47E-08		3.20E-07	3.75E-07		0.00E+00		0.00E+00	0.00E+00
			Benzo(a)pyrene	5.83E-07		3.41E-06	4.00E-06		0.00E+00		0.00E+00	0.00E+00
			Benzo(b)fluoranthene	6.80E-08		3.98E-07	4.66E-07		0.00E+00		0.00E+00	0.00E+00
			Benzo(k)fluoranthene	6.71E-09		3.93E-08	4.60E-08		0.00E+00		0.00E+00	0.00E+00
			Chrysene	8.80E-10		5.15E-09	6.03E-09		0.00E+00		0.00E+00	0.00E+00
			Dibenz(ah)anthracene	2.10E-07		1.23E-06	1.44E-06		0.00E+00		0.00E+00	0.00E+00
			Indeno(1,2,3-cd)pyrene	5.13E-08		3.00E-07	3.51E-07		0.00E+00		0.00E+00	0.00E+00
			Naphthalene	0.00E+00		0.00E+00	0.00E+00		4.91E-05		2.87E-04	3.36E-04
			Bis(2-ethylhexyl) phthalate	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			PCB 1254	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			PCBs, total	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00

TABLE C-25
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
RAGS TABLE 9 RME
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			DDD, p,p'-	1.00E-08		1.35E-08	2.36E-08		4.87E-05		6.58E-05	1.15E-04
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
	Exposure Medium Total						6.8E-05					6.0E-01
	Surface Water	Grove Pond Surface Water	Aluminum	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Antimony	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Arsenic	5.05E-06		2.26E-06	7.30E-06		3E-02		2.51E-02	5.12E-02
			Barium	0.00E+00		0.00E+00	0.00E+00		4E-03		4.90E-02	5.26E-02
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Chromium, total	0.00E+00		0.00E+00	0.00E+00		3E-03		3.72E-01	3.75E-01
			Copper	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Iron	0.00E+00		0.00E+00	0.00E+00		2E-02		2.26E-02	4.62E-02
			Lead	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00		5E-01		1.14E+01	1.19E+01
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Mercury	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Selenium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Thallium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Vanadium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Zinc	0.00E+00		0.00E+00	0.00E+00		2E-03		1.41E-03	3.86E-03
			Chloroform	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Hexachlorocyclohexane, alpha-	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Methylene chloride	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benz(a)anthracene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benzo(a)pyrene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benzo(b)fluoranthene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benzo(k)fluoranthene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Chrysene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Dibenz(ah)anthracene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Indeno(1,2,3-cd)pyrene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Naphthalene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00

TABLE C-25

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Bis(2-ethylhexyl) phthalate	2.15E-08		1.36E-06	1.38E-06		2E-04		2.42E-02	2.44E-02
			PCB 1254	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			PCBs, total	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			DDD, p,p'-	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
	Exposure Medium Total						8.7E-06					1.2E+01
Fish Tissue	Fish Tissue	Fish Tissue- Grove Pond	Aluminum	0.00E+00			0.00E+00		0E+00			0.00E+00
			Antimony	0.00E+00			0.00E+00		0E+00			0.00E+00
			Arsenic	0.00E+00			0.00E+00		0E+00			0.00E+00
			Barium	0.00E+00			0.00E+00		0E+00			0.00E+00
			Cadmium (in solid media)	0.00E+00			0.00E+00		3E-02			2.68E-02
			Cadmium (in water)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Chromium, total	0.00E+00			0.00E+00		3E-02			3.36E-02
			Copper	0.00E+00			0.00E+00		0E+00			0.00E+00
			Iron	0.00E+00			0.00E+00		0E+00			0.00E+00
			Lead	0.00E+00			0.00E+00		0E+00			0.00E+00
			Manganese (in sediment or water)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Manganese (in food)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Mercury	0.00E+00			0.00E+00		6E-01			6.03E-01
			Selenium	0.00E+00			0.00E+00		0E+00			0.00E+00
			Thallium	0.00E+00			0.00E+00		0E+00			0.00E+00
			Vanadium	0.00E+00			0.00E+00		3E-02			2.60E-02
			Zinc	0.00E+00			0.00E+00		0E+00			0.00E+00
			Chloroform	0.00E+00			0.00E+00		0E+00			0.00E+00
			Hexachlorocyclohexane, alpha-	0.00E+00			0.00E+00		0E+00			0.00E+00
			Methylene chloride	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benz(a)anthracene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benzo(a)pyrene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benzo(b)fluoranthene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benzo(k)fluoranthene	0.00E+00			0.00E+00		0E+00			0.00E+00

TABLE C-25
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
RAGS TABLE 9 RME
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Chrysene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Dibenz(ah)anthracene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Indeno(1,2,3-cd)pyrene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Naphthalene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Bis(2-ethylhexyl) phthalate	0.00E+00			0.00E+00		0E+00			0.00E+00
			PCB 1254	0.00E+00			0.00E+00		0E+00			0.00E+00
			PCBs, total	2.69E-05			2.69E-05		2E+00			1.57E+00
			DDD, p,p'-	7.61E-07			7.61E-07		4E-03			3.70E-03
			DDE, p,p'-	2.25E-06			2.25E-06		8E-03			7.72E-03
	Exposure Medium Total						3.0E-05					2.3E+00

Total Risk Across all Media: 1.1E-04

Total Hazards Across all Media: 1.5E+01

Target organ across all exposure pathways: Central nervous system =	1.19E+01
Target organ across all exposure pathways: Blood =	1.15E-02
Target organ across all exposure pathways: Skin =	3.68E-01
Target organ across all exposure pathways: Cardiovascular system =	5.26E-02
Target organ across all exposure pathways: Kidney =	6.16E-02
Target organ across all exposure pathways: Gatrointestinal System =	4.89E-01
Target organ across all exposure pathways: Immune system =	2.25E+00
Target organ across all exposure pathways: Liver =	1.38E-01
Target organ across all exposure pathways: Whole body/growth =	3.73E-02

TABLE C-26

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Sediment	Near-shore Grove Pond Sediment	Aluminum	0.00E+00		0.00E+00	0.00E+00		4.85E-02		0.00E+00	4.85E-02
			Antimony	0.00E+00		0.00E+00	0.00E+00		7.10E-02		0.00E+00	7.10E-02
			Arsenic	4.85E-05		1.20E-05	6.05E-05		1.26E+00		3.11E-01	1.57E+00
			Barium	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00		1.16E-01		3.83E-02	1.54E-01
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Chromium, total	0.00E+00		0.00E+00	0.00E+00		1.15E-01		0.00E+00	1.15E-01
			Copper	0.00E+00		0.00E+00	0.00E+00		5.13E-02		0.00E+00	5.13E-02
			Iron	0.00E+00		0.00E+00	0.00E+00		1.52E-01		0.00E+00	1.52E-01
			Lead	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00		7.17E-02		0.00E+00	7.17E-02
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Mercury	0.00E+00		0.00E+00	0.00E+00		7.51E-01		0.00E+00	7.51E-01
			Selenium	0.00E+00		0.00E+00	0.00E+00		4.66E-03		0.00E+00	4.66E-03
			Thallium	0.00E+00		0.00E+00	0.00E+00		9.55E-01		0.00E+00	9.55E-01
			Vanadium	0.00E+00		0.00E+00	0.00E+00		1.02E-01		0.00E+00	1.02E-01
			Zinc	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Chloroform	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Hexachlorocyclohexane, alpha-	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Methylene chloride	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Benz(a)anthracene	1.02E-07		0.00E+00	1.02E-07		0.00E+00		0.00E+00	0.00E+00
			Benzo(a)pyrene	1.09E-06		1.17E-06	2.26E-06		0.00E+00		0.00E+00	0.00E+00
			Benzo(b)fluoranthene	1.27E-07		1.36E-07	2.63E-07		0.00E+00		0.00E+00	0.00E+00
			Benzo(k)fluoranthene	1.25E-08		1.34E-09	2.60E-08		0.00E+00		0.00E+00	0.00E+00
			Chrysene	1.64E-09		1.76E-09	3.41E-09		0.00E+00		0.00E+00	0.00E+00
			Dibenz(ah)anthracene	3.93E-07		4.21E-07	8.14E-07		0.00E+00		0.00E+00	0.00E+00
			Indeno(1,2,3-cd)pyrene	9.58E-08		1.03E-07	1.98E-07		0.00E+00		0.00E+00	0.00E+00
			Naphthalene	0.00E+00		0.00E+00	0.00E+00		4.58E-04		4.92E-04	9.50E-04
			Bis(2-ethylhexyl) phthalate	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			PCB 1254	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			PCBs, total	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00

TABLE C-26

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			DDD, p,p'-	1.67E-08		4.63E-09	2.33E-08		4.55E-04		1.13E-04	5.67E-04
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
	Exposure Medium Total						6.4E-05					4.0E+00
	Surface Water	Grove Pond Surface Water	Aluminum	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Antimony	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Arsenic	2.35E-05		7.73E-07	2.43E-05		6E-01		2.00E-02	6.30E-01
			Barium	0.00E+00		0.00E+00	0.00E+00		8E-02		3.91E-02	1.23E-01
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Chromium, total	0.00E+00		0.00E+00	0.00E+00		6E-02		2.97E-01	3.56E-01
			Copper	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Iron	0.00E+00		0.00E+00	0.00E+00		6E-01		1.81E-02	5.69E-01
			Lead	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00		1E+01		9.14E+00	2.03E+01
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Mercury	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Selenium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Thallium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Vanadium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Zinc	0.00E+00		0.00E+00	0.00E+00		6E-02		1.13E-03	5.83E-02
			Chloroform	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Hexachlorocyclohexane, alpha-	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Methylene chloride	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benz(a)anthracene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benzo(a)pyrene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benzo(b)fluoranthene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benzo(k)fluoranthene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Chrysene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Dibenz(ah)anthracene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Indeno(1,2,3-cd)pyrene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Naphthalene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00

TABLE C-26

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Bis(2-ethylhexyl) phthalate	1.00E-07		4.64E-07	5.64E-07		4E-03		1.93E-02	2.35E-02
			PCB 1254	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			PCBs, total	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			DDD, p,p'-	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
	Exposure Medium Total						2.5E-05					2.2E+01
Fish Tissue	Fish Tissue	Fish Tissue- Grove Pond	Aluminum	0.00E+00			0.00E+00		0E+00			0.00E+00
			Antimony	0.00E+00			0.00E+00		0E+00			0.00E+00
			Arsenic	0.00E+00			0.00E+00		0E+00			0.00E+00
			Barium	0.00E+00			0.00E+00		0E+00			0.00E+00
			Cadmium (in solid media)	0.00E+00			0.00E+00		5E-02			4.68E-02
			Cadmium (in water)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Chromium, total	0.00E+00			0.00E+00		6E-02			5.90E-02
			Copper	0.00E+00			0.00E+00		0E+00			0.00E+00
			Iron	0.00E+00			0.00E+00		0E+00			0.00E+00
			Lead	0.00E+00			0.00E+00		0E+00			0.00E+00
			Manganese (in sediment or water)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Manganese (in food)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Mercury	0.00E+00			0.00E+00		1E+00			1.06E+00
			Selenium	0.00E+00			0.00E+00		0E+00			0.00E+00
			Thallium	0.00E+00			0.00E+00		0E+00			0.00E+00
			Vanadium	0.00E+00			0.00E+00		5E-02			4.55E-02
			Zinc	0.00E+00			0.00E+00		0E+00			0.00E+00
			Chloroform	0.00E+00			0.00E+00		0E+00			0.00E+00
			Hexachlorocyclohexane, alpha-	0.00E+00			0.00E+00		0E+00			0.00E+00
			Methylene chloride	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benz(a)anthracene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benzo(a)pyrene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benzo(b)fluoranthene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benzo(k)fluoranthene	0.00E+00			0.00E+00		0E+00			0.00E+00

TABLE C-26

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Chrysene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Dibenz(ah)anthracene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Indeno(1,2,3-cd)pyrene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Naphthalene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Bis(2-ethylhexyl) phthalate	0.00E+00			0.00E+00		0E+00			0.00E+00
			PCB 1254	0.00E+00			0.00E+00		0E+00			0.00E+00
			PCBs, total	9.38E-06			9.38E-06		3E+00			2.74E+00
			DDD, p,p'-	2.66E-07			2.66E-07		6E-03			8.46E-03
			DDE, p,p'-	7.87E-07			7.87E-07		1E-02			1.36E-02
	Exposure Medium Total						1.0E-05					4.0E+00

Total Risk Across all Media	1.0E-04	Total Hazards Across all Media	3.0E+01

Receptor HI Total	
Target organ across all exposure pathways: Central nervous system =	2.04E+01
Target organ across all exposure pathways: Blood =	1.29E-01
Target organ across all exposure pathways: Skin =	2.20E+00
Target organ across all exposure pathways: Cardiovascular system =	1.23E-01
Target organ across all exposure pathways: Kidney =	2.01E-01
Target organ across all exposure pathways: Gatrointestinal System =	1.30E+00
Target organ across all exposure pathways: Immune system =	4.54E+00
Target organ across all exposure pathways: Liver =	9.99E-01
Target organ across all exposure pathways: Whole body/growth =	1.48E-01

TABLE C-27

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Sediment	Near-shore Plow Shop Pond	Aluminum	0.00E+00		0.00E+00	0.00E+00		2.47E-03		0.00E+00	2.47E-03
			Antimony	0.00E+00		0.00E+00	0.00E+00		1.09E-02		0.00E+00	1.09E-02
			Arsenic	1.53E-04		2.06E-04	3.59E-04		7.93E-01		1.07E+00	1.86E+00
			Barium	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00		3.91E-03		7.04E-03	1.10E-02
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Chromium, total	0.00E+00		0.00E+00	0.00E+00		1.04E+00		0.00E+00	1.04E+00
			Copper	0.00E+00		0.00E+00	0.00E+00		2.05E-03		0.00E+00	2.05E-03
			Iron	0.00E+00		0.00E+00	0.00E+00		8.21E-02		0.00E+00	8.21E-02
			Lead	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00		3.22E-02		0.00E+00	3.22E-02
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Mercury	0.00E+00		0.00E+00	0.00E+00		2.96E-02		0.00E+00	2.96E-02
			Selenium	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Thallium	0.00E+00		0.00E+00	0.00E+00		5.19E-02		0.00E+00	5.19E-02
			Vanadium	0.00E+00		0.00E+00	0.00E+00		9.11E-03		0.00E+00	9.11E-03
			Zinc	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Chloroform	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Hexachlorocyclohexane, alpha-	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Methylene chloride	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Benz(a)anthracene	2.92E-07		0.00E+00	2.92E-07		0.00E+00		0.00E+00	0.00E+00
			Benzo(a)pyrene	3.74E-06		2.19E-05	2.56E-05		0.00E+00		0.00E+00	0.00E+00
			Benzo(b)fluoranthene	3.12E-07		1.83E-06	2.14E-06		0.00E+00		0.00E+00	0.00E+00
			Benzo(k)fluoranthene	1.15E-08		6.74E-08	7.89E-08		0.00E+00		0.00E+00	0.00E+00
			Chrysene	3.43E-09		2.00E-08	2.35E-08		0.00E+00		0.00E+00	0.00E+00
			Dibenz(ah)anthracene	7.68E-07		4.49E-06	5.26E-06		0.00E+00		0.00E+00	0.00E+00
			Indeno(1,2,3-cd)pyrene	2.93E-07		1.71E-06	2.01E-06		0.00E+00		0.00E+00	0.00E+00
			Naphthalene	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Bis(2-ethylhexyl) phthalate	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			PCB 1254	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			PCBs, total	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			DDD, p,p'-	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00

TABLE C-27

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
	Exposure Medium Total						3.9E-04					3.1E+00
	Surface Water	Plow Shop Pond Surface Water	Aluminum	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Antimony	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Arsenic	9.93E-06		4.45E-06	1.44E-05		5E-02		4.94E-02	1.01E-01
			Barium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Chromium, total	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Copper	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Iron	0.00E+00		0.00E+00	0.00E+00		2E-03		1.06E-03	2.99E-03
			Lead	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00		6E-04		1.51E-02	1.58E-02
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Mercury	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Selenium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Thallium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Vanadium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Zinc	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Chloroform	0.00E+00		0.00E+00	0.00E+00		1E-05		1.09E-04	1.23E-04
			Hexachlorocyclohexane, alpha-	1.45E-08		2.11E-07	2.25E-07		1E-05		3.34E-04	3.48E-04
			Methylene chloride	2.64E-09		4.80E-09	7.45E-09		1E-05		6.34E-05	6.71E-05
			Benz(a)anthracene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benzo(a)pyrene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benzo(b)fluoranthene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benzo(k)fluoranthene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Chrysene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Dibenz(ah)anthracene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Indeno(1,2,3-cd)pyrene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Naphthalene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Bis(2-ethylhexyl) phthalate	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			PCB 1254	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00

TABLE C-27

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			PCBs, total	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			DDD, p,p'-	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
	Exposure Medium Total						1.5E-05					1.2E-01
Fish Tissue	Fish Tissue	Fish Tissue- Plow Shop Pond	Aluminum	0.00E+00			0.00E+00		0E+00			0.00E+00
			Antimony	0.00E+00			0.00E+00		0E+00			0.00E+00
			Arsenic	1.86E-05			1.86E-05		1E-01			9.07E-02
			Barium	0.00E+00			0.00E+00		0E+00			0.00E+00
			Cadmium (in solid media)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Cadmium (in water)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Chromium, total	0.00E+00			0.00E+00		0E+00			0.00E+00
			Copper	0.00E+00			0.00E+00		0E+00			0.00E+00
			Iron	0.00E+00			0.00E+00		0E+00			0.00E+00
			Lead	0.00E+00			0.00E+00		0E+00			0.00E+00
			Manganese (in sediment or water)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Manganese (in food)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Mercury	0.00E+00			0.00E+00		3E+00			3.14E+00
			Selenium	0.00E+00			0.00E+00		0E+00			0.00E+00
			Thallium	0.00E+00			0.00E+00		0E+00			0.00E+00
			Vanadium	0.00E+00			0.00E+00		2E-01			1.64E-01
			Zinc	0.00E+00			0.00E+00		0E+00			0.00E+00
			Chloroform	0.00E+00			0.00E+00		0E+00			0.00E+00
			Hexachlorocyclohexane, alpha-	0.00E+00			0.00E+00		0E+00			0.00E+00
			Methylene chloride	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benz(a)anthracene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benzo(a)pyrene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benzo(b)fluoranthene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benzo(k)fluoranthene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Chrysene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Dibenz(ah)anthracene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Indeno(1,2,3-cd)pyrene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Naphthalene	0.00E+00			0.00E+00		0E+00			0.00E+00

TABLE C-27

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Bis(2-ethylhexyl) phthalate	0.00E+00			0.00E+00		0E+00			0.00E+00
			PCB 1254	0.00E+00			0.00E+00		0E+00			0.00E+00
			PCBs, total	0.00E+00			0.00E+00		0E+00			0.00E+00
			DDD, p,p'-	0.00E+00			0.00E+00		0E+00			0.00E+00
			DDE, p,p'-	9.93E-07			9.93E-07		3E-03			3.41E-03
	Exposure Medium Total						2.0E-05					3.4E+00

Total Risk Across all Media: 4.3E-04

Total Hazards Across all Media: 6.7E+00

	Receptor HI Total
Target organ across all exposure pathways: Central nervous system =	5.04E-02
Target organ across all exposure pathways: Blood =	1.09E-02
Target organ across all exposure pathways: Skin =	2.06E+00
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	1.13E-02
Target organ across all exposure pathways: Gatrointestinal System =	1.13E+00
Target organ across all exposure pathways: Immune system =	3.17E+00
Target organ across all exposure pathways: Liver =	5.55E-02
Target organ across all exposure pathways: Whole body/growth =	1.73E-01

TABLE C-28
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
RAGS TABLE 9 RME
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Sediment	Near-shore Plow Shop Pond	Aluminum	0.00E+00		0.00E+00	0.00E+00		2.31E-02		0.00E+00	2.31E-02
			Antimony	0.00E+00		0.00E+00	0.00E+00		1.02E-01		0.00E+00	1.02E-01
			Arsenic	2.85E-04		7.07E-05	3.56E-04		7.40E+00		1.83E+00	9.23E+00
			Barium	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00		3.65E-02		1.21E-02	4.86E-02
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Chromium, total	0.00E+00		0.00E+00	0.00E+00		9.71E+00		0.00E+00	9.71E+00
			Copper	0.00E+00		0.00E+00	0.00E+00		1.92E-02		0.00E+00	1.92E-02
			Iron	0.00E+00		0.00E+00	0.00E+00		7.66E-01		0.00E+00	7.66E-01
			Lead	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00		3.00E-01		0.00E+00	3.00E-01
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Mercury	0.00E+00		0.00E+00	0.00E+00		2.76E-01		0.00E+00	2.76E-01
			Selenium	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Thallium	0.00E+00		0.00E+00	0.00E+00		4.85E-01		0.00E+00	4.85E-01
			Vanadium	0.00E+00		0.00E+00	0.00E+00		8.50E-02		0.00E+00	8.50E-02
			Zinc	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Chloroform	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Hexachlorocyclohexane, alpha-	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Methylene chloride	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Benz(a)anthracene	5.45E-07		0.00E+00	5.45E-07		0.00E+00		0.00E+00	0.00E+00
			Benzo(a)pyrene	6.98E-06		7.48E-06	1.45E-05		0.00E+00		0.00E+00	0.00E+00
			Benzo(b)fluoranthene	5.83E-07		6.25E-07	1.21E-06		0.00E+00		0.00E+00	0.00E+00
			Benzo(k)fluoranthene	2.15E-08		2.31E-08	4.46E-08		0.00E+00		0.00E+00	0.00E+00
			Chrysene	6.39E-09		6.86E-09	1.33E-08		0.00E+00		0.00E+00	0.00E+00
			Dibenz(ah)anthracene	1.43E-06		1.54E-06	2.97E-06		0.00E+00		0.00E+00	0.00E+00
			Indeno(1,2,3-cd)pyrene	5.47E-07		5.86E-07	1.13E-06		0.00E+00		0.00E+00	0.00E+00
			Naphthalene	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			Bis(2-ethylhexyl) phthalate	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			PCB 1254	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			PCBs, total	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00

TABLE C-28
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
RAGS TABLE 9 RME
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			DDD, p,p'-	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
	Exposure Medium Total						3.8E-04					2.1E+01
	Surface Water	Plow Shop Pond Surface Water	Aluminum	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Antimony	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Arsenic	4.64E-05		1.52E-06	4.79E-05		1E+00		3.94E-02	1.24E+00
			Barium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Chromium, total	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Copper	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Iron	0.00E+00		0.00E+00	0.00E+00		5E-02		1.56E-03	4.91E-02
			Lead	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00		1E-02		1.21E-02	2.68E-02
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Mercury	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Selenium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Thallium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Vanadium	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Zinc	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Chloroform	0.00E+00		0.00E+00	0.00E+00		3E-04		8.72E-05	4.00E-04
			Hexachlorocyclohexane, alpha-	6.76E-08		7.21E-08	1.40E-07		3E-04		2.67E-04	5.17E-04
			Methylene chloride	1.23E-08		1.64E-09	1.40E-08		3E-04		4.26E-05	3.63E-04
			Benz(a)anthracene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benzo(a)pyrene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benzo(b)fluoranthene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Benzo(k)fluoranthene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Chrysene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Dibenz(ah)anthracene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Indeno(1,2,3-cd)pyrene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			Naphthalene	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00

TABLE C-28
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
RAGS TABLE 9 RME
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Bis(2-ethylhexyl) phthalate	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			PCB 1254	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			PCBs, total	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			DDD, p,p'-	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00		0E+00		0.00E+00	0.00E+00
	Exposure Medium Total						4.8E-05					1.3E+00
Fish Tissue	Fish Tissue	Fish Tissue- Plow Shop Pond	Aluminum	0.00E+00			0.00E+00		0E+00			0.00E+00
			Antimony	0.00E+00			0.00E+00		0E+00			0.00E+00
			Arsenic	6.51E-06			6.51E-06		2E-01			1.09E-01
			Barium	0.00E+00			0.00E+00		0E+00			0.00E+00
			Cadmium (in solid media)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Cadmium (in water)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Chromium, total	0.00E+00			0.00E+00		0E+00			0.00E+00
			Copper	0.00E+00			0.00E+00		0E+00			0.00E+00
			Iron	0.00E+00			0.00E+00		0E+00			0.00E+00
			Lead	0.00E+00			0.00E+00		0E+00			0.00E+00
			Manganese (in sediment or water)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Manganese (in food)	0.00E+00			0.00E+00		0E+00			0.00E+00
			Mercury	0.00E+00			0.00E+00		5E+00			5.50E+00
			Selenium	0.00E+00			0.00E+00		0E+00			0.00E+00
			Thallium	0.00E+00			0.00E+00		0E+00			0.00E+00
			Vanadium	0.00E+00			0.00E+00		3E-01			2.86E-01
			Zinc	0.00E+00			0.00E+00		0E+00			0.00E+00
			Chloroform	0.00E+00			0.00E+00		0E+00			0.00E+00
			Hexachlorocyclohexane, alpha-	0.00E+00			0.00E+00		0E+00			0.00E+00
			Methylene chloride	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benz(a)anthracene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benzo(a)pyrene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benzo(b)fluoranthene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Benzo(k)fluoranthene	0.00E+00			0.00E+00		0E+00			0.00E+00

TABLE C-28

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 9 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Chrysene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Dibenz(ah)anthracene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Indeno(1,2,3-cd)pyrene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Naphthalene	0.00E+00			0.00E+00		0E+00			0.00E+00
			Bis(2-ethylhexyl) phthalate	0.00E+00			0.00E+00		0E+00			0.00E+00
			PCB 1254	0.00E+00			0.00E+00		0E+00			0.00E+00
			PCBs, total	0.00E+00			0.00E+00		0E+00			0.00E+00
			DDD, p,p'-	0.00E+00			0.00E+00		0E+00			0.00E+00
			DDE, p,p'-	3.47E-07			3.47E-07		6E-03			5.95E-03
	Exposure Medium Total						6.9E-06					6.0E+00

Total Risk Across all Media	4.3E-04	Total Hazards Across all Media	2.8E+01

Target organ across all exposure pathways: Central nervous system =	3.2E-01
Target organ across all exposure pathways: Blood =	1.0E-01
Target organ across all exposure pathways: Skin =	9.2E+00
Target organ across all exposure pathways: Cardiovascular system =	0.0E+00
Target organ across all exposure pathways: Kidney =	4.9E-02
Target organ across all exposure pathways: Gatrointestinal System =	1.0E+01
Target organ across all exposure pathways: Immune system =	2.6E-01
Target organ across all exposure pathways: Liver =	4.6E-01
Target organ across all exposure pathways: Whole body/growth =	8.5E-02

TABLE C-29
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
RAGS TABLE 10 RME
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
Sediment	Sediment	Near-shore Grove Pond Sediment	Aluminum	0.00E+00		0.00E+00	0.00E+00	–		5.19E-03		0.00E+00	5.19E-03	–
			Antimony	0.00E+00		0.00E+00	0.00E+00	–		7.61E-03		0.00E+00	7.61E-03	–
			Arsenic	2.60E-05		3.51E-05	6.11E-05	Yes		1.35E-01		1.82E-01	3.17E-01	–
			Barium	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00	–		1.24E-02		2.24E-02	3.48E-02	–
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Chromium, total	0.00E+00		0.00E+00	0.00E+00	–		1.23E-02		0.00E+00	1.23E-02	–
			Copper	0.00E+00		0.00E+00	0.00E+00	–		5.50E-03		0.00E+00	5.50E-03	–
			Iron	0.00E+00		0.00E+00	0.00E+00	–		1.63E-02		0.00E+00	1.63E-02	–
			Lead	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00	–		7.88E-03		0.00E+00	7.88E-03	–
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Mercury	0.00E+00		0.00E+00	0.00E+00	–		8.05E-02		0.00E+00	8.05E-02	–
			Selenium	0.00E+00		0.00E+00	0.00E+00	–		4.99E-04		0.00E+00	4.99E-04	–
			Thallium	0.00E+00		0.00E+00	0.00E+00	–		1.02E-01		0.00E+00	1.02E-01	–
			Vanadium	0.00E+00		0.00E+00	0.00E+00	–		1.09E-02		0.00E+00	1.09E-02	–
			Zinc	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Chloroform	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Hexachlorocyclohexane, alpha-	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Methylene chloride	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Benz(a)anthracene	5.47E-08		3.20E-07	3.75E-07	–		0.00E+00		0.00E+00	0.00E+00	–
			Benzo(a)pyrene	5.83E-07		3.41E-06	4.00E-06	Yes		0.00E+00		0.00E+00	0.00E+00	–
			Benzo(b)fluoranthene	6.80E-08		3.98E-07	4.66E-07	–		0.00E+00		0.00E+00	0.00E+00	–
			Benzo(k)fluoranthene	6.71E-09		3.93E-08	4.60E-08	–		0.00E+00		0.00E+00	0.00E+00	–
			Chrysene	8.80E-10		5.15E-09	6.03E-09	–		0.00E+00		0.00E+00	0.00E+00	–
			Dibenz(ah)anthracene	2.10E-07		1.23E-06	1.44E-06	Yes		0.00E+00		0.00E+00	0.00E+00	–
			Indeno(1,2,3-cd)pyrene	5.13E-08		3.00E-07	3.51E-07	–		0.00E+00		0.00E+00	0.00E+00	–
			Naphthalene	0.00E+00		0.00E+00	0.00E+00	–		4.31E-05		2.87E-04	3.30E-04	–
			Bis(2-ethylhexyl) phthalate	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			PCB 1254	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			PCBs, total	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			DDD, p,p'-	1.00E-08		1.36E-08	2.36E-08	–		4.97E-05		6.58E-05	1.15E-04	–
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
	Exposure Medium Total						6.8E-05	Yes					6.0E-01	–

TABLE C-29
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
RAGS TABLE 10 RME
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
	Surface Water	Grove Pond Surface Water	Aluminum	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Antimony	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Arsenic	5.05E-06		2.26E-06	7.30E-06	Yes		3E-02		2.51E-02	5.12E-02	–
			Barium	0.00E+00		0.00E+00	0.00E+00	–		4E-03		4.90E-02	5.26E-02	–
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Chromium, total	0.00E+00		0.00E+00	0.00E+00	–		3E-03		3.72E-01	3.75E-01	–
			Copper	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Iron	0.00E+00		0.00E+00	0.00E+00	–		2E-02		2.26E-02	4.02E-02	–
			Lead	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00	–		5E-01		1.14E+01	1.16E+01	Yes
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Mercury	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Selenium	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Thallium	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Vanadium	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Zinc	0.00E+00		0.00E+00	0.00E+00	–		2E-03		1.41E-03	3.86E-03	–
			Chloroform	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Hexachlorocyclohexane, alpha-	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Methylene chloride	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Benz(a)anthracene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Benzo(a)pyrene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Benzo(b)fluoranthene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Benzo(k)fluoranthene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Chrysene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Dibenz(ah)anthracene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Indeno(1,2,3-cd)pyrene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Naphthalene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Bis(2-ethylhexyl) phthalate	2.15E-08		1.36E-06	1.38E-06	Yes		2E-04		2.42E-02	2.44E-02	–
			PCB 1254	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			PCBs, total	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			DDD, p,p'-	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
	Exposure Medium Total						8.7E-06	Yes					1.2E+01	Yes

TABLE C-29
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
RAGS TABLE 10 RME
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-4	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
Fish Tissue	Fish Tissue	Fish Tissue- Grove Pond	Aluminum	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Antimony	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Arsenic	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Barium	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Cadmium (in solid media)	0.00E+00			0.00E+00	–		3E-02			2.68E-02	–
			Cadmium (in water)	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Chromium, total	0.00E+00			0.00E+00	–		3E-02			3.39E-02	–
			Copper	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Iron	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Lead	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Manganese (in sediment or water)	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Manganese (in food)	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Mercury	0.00E+00			0.00E+00	–		6E-01			6.03E-01	–
			Selenium	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Thallium	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Vanadium	0.00E+00			0.00E+00	–		3E-02			2.60E-02	–
			Zinc	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Chloroform	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Hexachlorocyclohexane, alpha-	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Methylene chloride	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Benz[a]anthracene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Benzo(a)pyrene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Benzo(b)fluoranthene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Benzo(k)fluoranthene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Chrysene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Dibenz(ah)anthracene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Indeno(1,2,3-cd)pyrene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Naphthalene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Bis(2-ethylhexyl) phthalate	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			PCB 1254	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			PCBs, total	2.69E-05			2.69E-05	Yes		2E+00			1.57E+00	Yes
			DDD, p,p'-	7.61E-07			7.61E-07	–		4E-03			3.70E-03	–
			DDE, p,p'-	2.25E-06			2.25E-06	Yes		8E-03			7.72E-03	–
	Exposure Medium Total						3.0E-05	Yes					2.3E+00	Yes

TABLE C-29

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 10 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1

Target organ across all exposure pathways: Central nervous system =	1.2E+01
Target organ across all exposure pathways: Blood =	1.1E-02
Target organ across all exposure pathways: Skin =	3.7E-01
Target organ across all exposure pathways: Cardiovascular system =	5.3E-02
Target organ across all exposure pathways: Kidney =	6.2E-02
Target organ across all exposure pathways: Gastrointestinal System =	4.9E-01
Target organ across all exposure pathways: Immune system =	2.3E+00
Target organ across all exposure pathways: Liver =	1.4E-01
Target organ across all exposure pathways: Whole body/growth =	3.7E-02

TABLE C-30

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 10 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
Sediment	Sediment	Near-shore Grove Pond Sediment	Aluminum	0.00E+00		0.00E+00	0.00E+00	–		4.85E-02		0.00E+00	4.85E-02	–
			Antimony	0.00E+00		0.00E+00	0.00E+00	–		7.10E-02		0.00E+00	7.10E-02	–
			Arsenic	4.85E-05		1.20E-05	6.05E-05	Yes		1.26E+00		3.11E-01	1.57E+00	Yes
			Barium	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00	–		1.16E-01		3.83E-02	1.54E-01	–
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Chromium, total	0.00E+00		0.00E+00	0.00E+00	–		1.15E-01		0.00E+00	1.15E-01	–
			Copper	0.00E+00		0.00E+00	0.00E+00	–		5.13E-02		0.00E+00	5.13E-02	–
			Iron	0.00E+00		0.00E+00	0.00E+00	–		1.52E-01		0.00E+00	1.52E-01	–
			Lead	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00	–		7.17E-02		0.00E+00	7.17E-02	–
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Mercury	0.00E+00		0.00E+00	0.00E+00	–		7.51E-01		0.00E+00	7.51E-01	–
			Selenium	0.00E+00		0.00E+00	0.00E+00	–		4.66E-03		0.00E+00	4.66E-03	–
			Thallium	0.00E+00		0.00E+00	0.00E+00	–		9.55E-01		0.00E+00	9.55E-01	–
			Vanadium	0.00E+00		0.00E+00	0.00E+00	–		1.02E-01		0.00E+00	1.02E-01	–
			Zinc	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Chloroform	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Hexachlorocyclohexane, alpha-	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Methylene chloride	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Benz(a)anthracene	1.02E-07		0.00E+00	1.02E-07	–		0.00E+00		0.00E+00	0.00E+00	–
			Benzo(a)pyrene	1.09E-06		1.17E-06	2.26E-06	Yes		0.00E+00		0.00E+00	0.00E+00	–
			Benzo(b)fluoranthene	1.27E-07		1.36E-07	2.63E-07	–		0.00E+00		0.00E+00	0.00E+00	–
			Benzo(k)fluoranthene	1.26E-08		1.34E-08	2.60E-08	–		0.00E+00		0.00E+00	0.00E+00	–
			Chrysene	1.64E-09		1.76E-09	3.41E-09	–		0.00E+00		0.00E+00	0.00E+00	–
			Dibenz(ah)anthracene	3.93E-07		4.21E-07	8.14E-07	–		0.00E+00		0.00E+00	0.00E+00	–
			Indeno(1,2,3-cd)pyrene	9.58E-08		1.03E-07	1.99E-07	–		0.00E+00		0.00E+00	0.00E+00	–
			Naphthalene	0.00E+00		0.00E+00	0.00E+00	–		4.56E-04		4.02E-04	8.58E-04	–
			Bis(2-ethylhexyl) phthalate	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			PCB 1254	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			PCBs, total	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			DDD, p,p'-	1.87E-08		4.63E-09	2.33E-08	–		4.55E-04		1.13E-04	5.67E-04	–
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
	Exposure Medium Total						6.4E-05	Yes					4.0E+00	Yes

TABLE C-30
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
RAGS TABLE 10 RME
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
	Surface Water	Grove Pond Surface Water	Aluminum	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Antimony	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Arsenic	2.35E-05		7.73E-07	2.43E-05	Yes		6E-01		2.00E-02	6.30E-01	–
			Barium	0.00E+00		0.00E+00	0.00E+00	–		8E-02		3.91E-02	1.23E-01	–
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Chromium, total	0.00E+00		0.00E+00	0.00E+00	–		6E-02		2.97E-01	3.56E-01	–
			Copper	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Iron	0.00E+00		0.00E+00	0.00E+00	–		6E-01		1.81E-02	5.69E-01	–
			Lead	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00	–		1E+01		9.14E+00	2.03E+01	Yes
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Mercury	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Selenium	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Thallium	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Vanadium	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Zinc	0.00E+00		0.00E+00	0.00E+00	–		6E-02		1.13E-03	5.83E-02	–
			Chloroform	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Hexachlorocyclohexane, alpha-	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Methylene chloride	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Benz(a)anthracene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Benzo(a)pyrene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Benzo(b)fluoranthene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Benzo(k)fluoranthene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Chrysene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Dibenz(ah)anthracene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Indeno(1,2,3-cd)pyrene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Naphthalene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Bis(2-ethylhexyl) phthalate	1.00E-07		4.04E-07	5.04E-07	–		4E-03		1.93E-02	2.35E-02	–
			PCB 1254	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			PCBs, total	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			DDD, p,p'-	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
	Exposure Medium Total						2.5E-05	Yes					2.2E+01	Yes

TABLE C-30

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 10 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
Fish Tissue	Fish Tissue	Fish Tissue- Grove Pond	Aluminum	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Antimony	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Arsenic	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Barium	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Cadmium (in solid media)	0.00E+00			0.00E+00	–		5E-02			4.68E-02	–
			Cadmium (in water)	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Chromium, total	0.00E+00			0.00E+00	–		6E-02			5.90E-02	–
			Copper	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Iron	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Lead	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Manganese (in sediment or water)	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Manganese (in food)	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Mercury	0.00E+00			0.00E+00	–		1E+00			1.05E+00	Yes
			Selenium	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Thallium	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Vanadium	0.00E+00			0.00E+00	–		5E-02			4.55E-02	–
			Zinc	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Chloroform	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Hexachlorocyclohexane, alpha-	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Methylene chloride	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Benz(a)anthracene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Benzo(a)pyrene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Benzo(b)fluoranthene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Benzo(k)fluoranthene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Chrysene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Dibenz(ah)anthracene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Indeno(1,2,3-cd)pyrene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Naphthalene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Bis(2-ethylhexyl) phthalate	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			PCB 1254	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			PCBs, total	9.38E-06			9.38E-06	Yes		3E+00			2.74E+00	Yes
			DDD, p,p'-	2.66E-07			2.66E-07	–		6E-03			6.46E-03	–
			DDE, p,p'-	7.87E-07			7.87E-07	–		1E-02			1.35E-02	–
	Exposure Medium Total						1.0E-05	Yes					4.0E+00	Yes

TABLE C-30

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 10 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1

Target organ across all exposure pathways: Central nervous system =	2.04E+01
Target organ across all exposure pathways: Blood =	1.29E-01
Target organ across all exposure pathways: Skin =	2.20E+00
Target organ across all exposure pathways: Cardiovascular system =	1.23E-01
Target organ across all exposure pathways: Kidney =	2.01E-01
Target organ across all exposure pathways: Gatrointestinal System =	1.30E+00
Target organ across all exposure pathways: Immune system =	4.54E+00
Target organ across all exposure pathways: Liver =	9.99E-01
Target organ across all exposure pathways: Whole body/growth =	1.40E-01

TABLE C-31
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
RAGS TABLE 10 RME
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Subsistence
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
Fish	Fish fillet	Grove Pond	Aluminum	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Antimony	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Arsenic	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Barium	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Cadmium (in solid media)	0.00E+00			0.00E+00	–		1.79E-01			1.79E-01	–
			Cadmium (in water)	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Chromium, total	0.00E+00			0.00E+00	–		2.25E-01			2.25E-01	–
			Copper	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Iron	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Lead	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Manganese (in sediment or water	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Manganese (in food)	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Mercury	0.00E+00			0.00E+00	–		4.02E+00			4.02E+00	Yes
			Selenium	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Thallium	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Vanadium	0.00E+00			0.00E+00	–		1.73E-01			1.73E-01	–
			Zinc	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Chloroform	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Hexachlorocyclohexane, alpha-	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Methylene chloride	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Benz(a)anthracene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Benzo(a)pyrene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Benzo(b)fluoranthene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Benzo(k)fluoranthene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Chrysene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Dibenz(ah)anthracene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Indeno(1,2,3-cd)pyrene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Naphthalene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Bis(2-ethylhexyl) phthalate	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			PCB 1254	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			PCBs, total	1.79E-04			1.79E-04	Yes		1.04E+01			1.04E+01	Yes
			DDD, p,p'-	5.06E-06			5.06E-06	Yes		2.46E-02			2.46E-02	–
			DDE, p,p'-	1.50E-05			1.50E-05	Yes		5.14E-02			5.14E-02	–
	Exposure Medium Total						2.0E-04	Yes					1.5E+01	Yes

Target organ across all exposure pathways: Central nervous system =	0.00E+00
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	0.00E+00
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	1.79E-01
Target organ across all exposure pathways: Gastrointestinal System =	2.25E-01
Target organ across all exposure pathways: Immune system =	1.44E+01
Target organ across all exposure pathways: Liver =	7.60E-02
Target organ across all exposure pathways: Whole body/growth =	1.73E-01

TABLE C-32

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 10 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Subsistence
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
Fish	Fish fillet	Grove Pond	Aluminum	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Antimony	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Arsenic	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Barium	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Cadmium (in solid media)	0.00E+00			0.00E+00	–		1.79E-01			6.24E-02	–
			Cadmium (in water)	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Chromium, total	0.00E+00			0.00E+00	–		2.25E-01			7.86E-02	–
			Copper	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Iron	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Lead	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Manganese (in sediment or water	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Manganese (in food)	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Mercury	0.00E+00			0.00E+00	–		4.02E+00			1.40E+00	Yes
			Selenium	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Thallium	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Vanadium	0.00E+00			0.00E+00	–		1.73E-01			6.06E-02	–
			Zinc	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Chloroform	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Hexachlorocyclohexane, alpha-	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Methylene chloride	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Benz(a)anthracene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Benzo(a)pyrene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Benzo(b)fluoranthene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Benzo(k)fluoranthene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Chrysene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Dibenz(ah)anthracene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Indeno(1,2,3-cd)pyrene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Naphthalene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Bis(2-ethylhexyl) phthalate	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			PCB 1254	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			PCBs, total	6.25E-05			6.25E-05	Yes		1.04E+01			3.64E+00	Yes
			DDD, p,p'-	1.77E-06			1.77E-06	Yes		2.46E-02			8.60E-03	–
			DDE, p,p'-	5.24E-06			5.24E-06	Yes		5.14E-02			1.80E-02	–
	Exposure Medium Total						6.9E-05	Yes					5.3E+00	Yes

Target organ across all exposure pathways: Central nervous system =	0.00E+00
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	0.00E+00
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	6.24E-02
Target organ across all exposure pathways: Gatrointestinal System =	7.86E-02
Target organ across all exposure pathways: Immune system =	5.05E+00
Target organ across all exposure pathways: Liver =	2.66E-02
Target organ across all exposure pathways: Whole body/growth =	6.06E-02

TABLE C-33

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 10 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
Sediment	Sediment	Near-shore Plow Shop Pond	Aluminum	0.00E+00		0.00E+00	0.00E+00	--		2.47E-03		0.00E+00	2.47E-03	--
			Antimony	0.00E+00		0.00E+00	0.00E+00	--		1.09E-02		0.00E+00	1.09E-02	--
			Arsenic	1.53E-04		2.06E-04	3.59E-04	Yes		7.93E-01		1.07E+00	1.86E+00	Yes
			Barium	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00	--		3.91E-03		7.04E-03	1.10E-02	--
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			Chromium, total	0.00E+00		0.00E+00	0.00E+00	--		1.04E+00		0.00E+00	1.04E+00	Yes
			Copper	0.00E+00		0.00E+00	0.00E+00	--		2.05E-03		0.00E+00	2.05E-03	--
			Iron	0.00E+00		0.00E+00	0.00E+00	--		8.21E-02		0.00E+00	8.21E-02	--
			Lead	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00	--		3.22E-02		0.00E+00	3.22E-02	--
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			Mercury	0.00E+00		0.00E+00	0.00E+00	--		2.96E-02		0.00E+00	2.96E-02	--
			Selenium	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			Thallium	0.00E+00		0.00E+00	0.00E+00	--		5.19E-02		0.00E+00	5.19E-02	--
			Vanadium	0.00E+00		0.00E+00	0.00E+00	--		9.11E-03		0.00E+00	9.11E-03	--
			Zinc	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			Chloroform	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			Hexachlorocyclohexane, alpha-	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			Methylene chloride	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			Benz(a)anthracene	2.92E-07		0.00E+00	2.92E-07	--		0.00E+00		0.00E+00	0.00E+00	--
			Benzo(a)pyrene	3.74E-06		2.19E-05	2.56E-05	Yes		0.00E+00		0.00E+00	0.00E+00	--
			Benzo(b)fluoranthene	3.12E-07		1.83E-06	2.14E-06	Yes		0.00E+00		0.00E+00	0.00E+00	--
			Benzo(k)fluoranthene	1.15E-08		6.74E-08	7.89E-08	--		0.00E+00		0.00E+00	0.00E+00	--
			Chrysene	3.43E-09		2.00E-08	2.35E-08	--		0.00E+00		0.00E+00	0.00E+00	--
			Dibenz(ah)anthracene	7.68E-07		4.49E-06	5.26E-06	Yes		0.00E+00		0.00E+00	0.00E+00	--
			Indeno(1,2,3-cd)pyrene	2.93E-07		1.71E-06	2.01E-06	Yes		0.00E+00		0.00E+00	0.00E+00	--
			Naphthalene	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			Bis(2-ethylhexyl) phthalate	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			PCB 1254	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			PCBs, total	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			DDD, p,p'-	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00	--		0.00E+00		0.00E+00	0.00E+00	--
	Exposure Medium Total						3.9E-04	Yes					3.1E+00	Yes

TABLE C-33
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
RAGS TABLE 10 RME
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
	Surface Water	Plow Shop Pond Surface Water	Aluminum	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Antimony	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Arsenic	9.93E-06		4.45E-06	1.44E-05	Yes		5E-02		4.94E-02	1.01E-01	–
			Barium	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Chromium, total	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Copper	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Iron	0.00E+00		0.00E+00	0.00E+00	–		2E-03		1.95E-03	3.99E-03	–
			Lead	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00	–		6E-04		1.51E-02	1.58E-02	–
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Mercury	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Selenium	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Thallium	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Vanadium	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Zinc	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Chloroform	0.00E+00		0.00E+00	0.00E+00	–		1E-05		1.09E-04	1.23E-04	–
			Hexachlorocyclohexane, alpha-	1.45E-08		2.11E-07	2.25E-07	–		1E-05		3.34E-04	3.45E-04	–
			Methylene chloride	2.64E-09		4.60E-09	7.45E-09	–		1E-05		5.34E-05	6.71E-05	–
			Benz(a)anthracene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Benzo(a)pyrene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Benzo(b)fluoranthene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Benzo(k)fluoranthene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Chrysene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Dibenz(ah)anthracene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Indeno(1,2,3-cd)pyrene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Naphthalene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Bis(2-ethylhexyl) phthalate	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			PCB 1254	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			PCBs, total	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			DDD, p,p'-	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
	Exposure Medium Total						1.6E-05	Yes					1.2E-01	–

TABLE C-33
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
RAGS TABLE 10 RME
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
Fish Tissue	Fish Tissue	Fish Tissue- Plow Shop Pond	Aluminum	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Antimony	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Arsenic	1.86E-05			1.86E-05	Yes		1E-01			9.07E-02	–
			Barium	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Cadmium (in solid media)	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Cadmium (in water)	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Chromium, total	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Copper	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Iron	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Lead	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Manganese (in sediment or water)	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Manganese (in food)	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Mercury	0.00E+00			0.00E+00	–		3E+00			3.14E+00	Yes
			Selenium	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Thallium	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Vanadium	0.00E+00			0.00E+00	–		2E-01			1.64E-01	–
			Zinc	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Chloroform	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Hexachlorocyclohexane, alpha-	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Methylene chloride	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Benz[a]anthracene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Benzo[a]pyrene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Benzo[b]fluoranthene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Benzo[k]fluoranthene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Chrysene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Dibenz[ah]anthracene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Indeno(1,2,3-cd)pyrene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Naphthalene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Bis(2-ethylhexyl) phthalate	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			PCB 1254	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			PCBs, total	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			DDD, p,p'-	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			DDE, p,p'-	9.90E-07			9.93E-07	–		3E-03			3.41E-03	–
	Exposure Medium Total						2.0E-05	Yes					3.4E+00	Yes

TABLE C-33
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
RAGS TABLE 10 RME
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1

Total Risk Across all Media: 4.3E-04

Total Hazards Across all Media: 6.7E+00

Target organ across all exposure pathways: Central nervous system =	5.04E-02
Target organ across all exposure pathways: Blood =	1.09E-02
Target organ across all exposure pathways: Skin =	2.05E+00
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	1.13E-02
Target organ across all exposure pathways: Gastrointestinal System =	1.13E+00
Target organ across all exposure pathways: Immune system =	3.17E+00
Target organ across all exposure pathways: Liver =	5.55E-02
Target organ across all exposure pathways: Whole body/growth =	1.73E-01

TABLE C-34

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 10 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
Sediment	Sediment	Near-shore Plow Shop Pond	Aluminum	0.00E+00		0.00E+00	0.00E+00	–		2.31E-02		0.00E+00	2.31E-02	–
			Antimony	0.00E+00		0.00E+00	0.00E+00	–		1.02E-01		0.00E+00	1.02E-01	–
			Arsenic	2.85E-04		7.07E-05	3.56E-04	Yes		7.40E+00		1.83E+00	9.23E+00	Yes
			Barium	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00	–		3.65E-02		1.21E-02	4.85E-02	–
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Chromium, total	0.00E+00		0.00E+00	0.00E+00	–		9.71E+00		0.00E+00	9.71E+00	Yes
			Copper	0.00E+00		0.00E+00	0.00E+00	–		1.92E-02		0.00E+00	1.92E-02	–
			Iron	0.00E+00		0.00E+00	0.00E+00	–		7.66E-01		0.00E+00	7.66E-01	–
			Lead	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00	–		3.00E-01		0.00E+00	3.00E-01	–
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Mercury	0.00E+00		0.00E+00	0.00E+00	–		2.78E-01		0.00E+00	2.78E-01	–
			Selenium	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Thallium	0.00E+00		0.00E+00	0.00E+00	–		4.85E-01		0.00E+00	4.85E-01	–
			Vanadium	0.00E+00		0.00E+00	0.00E+00	–		8.50E-02		0.00E+00	8.50E-02	–
			Zinc	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Chloroform	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Hexachlorocyclohexane, alpha-	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Methylene chloride	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Benz(a)anthracene	5.45E-07		0.00E+00	5.45E-07	–		0.00E+00		0.00E+00	0.00E+00	–
			Benzo(a)pyrene	6.98E-06		7.48E-06	1.45E-05	Yes		0.00E+00		0.00E+00	0.00E+00	–
			Benzo(b)fluoranthene	5.83E-07		6.25E-07	1.21E-06	Yes		0.00E+00		0.00E+00	0.00E+00	–
			Benzo(k)fluoranthene	2.15E-08		2.31E-08	4.46E-08	–		0.00E+00		0.00E+00	0.00E+00	–
			Chrysene	6.39E-09		6.86E-09	1.33E-08	–		0.00E+00		0.00E+00	0.00E+00	–
			Dibenz(ah)anthracene	1.43E-06		1.54E-06	2.97E-06	Yes		0.00E+00		0.00E+00	0.00E+00	–
			Indeno(1,2,3-cd)pyrene	5.47E-07		5.86E-07	1.13E-06	Yes		0.00E+00		0.00E+00	0.00E+00	–
			Naphthalene	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			Bis(2-ethylhexyl) phthalate	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			PCB 1254	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			PCBs, total	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			DDD, p,p'-	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00	–		0.00E+00		0.00E+00	0.00E+00	–
	Exposure Medium Total						3.6E-04	Yes					2.1E+01	Yes

TABLE C-34
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
RAGS TABLE 10 RME
FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
	Surface Water	Plow Shop Pond Surface Water	Aluminum	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Antimony	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Arsenic	4.64E-05		1.52E-06	4.79E-05	Yes		1E+00		3.94E-02	1.24E+00	Yes
			Barium	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Cadmium (in solid media)	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Cadmium (in water)	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Chromium, total	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Copper	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Iron	0.00E+00		0.00E+00	0.00E+00	–		5E-02		1.56E-03	4.91E-02	–
			Lead	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Manganese (in sediment or water)	0.00E+00		0.00E+00	0.00E+00	–		1E-02		1.21E-02	2.80E-02	–
			Manganese (in food)	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Mercury	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Selenium	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Thallium	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Vanadium	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Zinc	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Chloroform	0.00E+00		0.00E+00	0.00E+00	–		3E-04		8.72E-05	4.00E-04	–
			Hexachlorocyclohexane, alpha-	6.76E-08		7.21E-08	1.40E-07	–		3E-04		2.07E-04	5.17E-04	–
			Methylene chloride	1.23E-08		1.64E-09	1.40E-08	–		3E-04		4.26E-05	3.63E-04	–
			Benz(a)anthracene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Benzo(a)pyrene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Benzo(b)fluoranthene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Benzo(k)fluoranthene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Chrysene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Dibenz(ah)anthracene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Indeno(1,2,3-cd)pyrene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Naphthalene	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			Bis(2-ethylhexyl) phthalate	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			PCB 1254	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			PCBs, total	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			DDD, p,p'-	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
			DDE, p,p'-	0.00E+00		0.00E+00	0.00E+00	–		0E+00		0.00E+00	0.00E+00	–
	Exposure Medium Total						4.8E-05	Yes					1.3E+00	Yes

TABLE C-34

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 10 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
Fish Tissue	Fish Tissue	Fish Tissue- Plow Shop Pond	Aluminum	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Antimony	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Arsenic	6.51E-06			6.51E-06	Yes		2E-01			1.69E-01	–
			Barium	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Cadmium (in solid media)	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Cadmium (in water)	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Chromium, total	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Copper	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Iron	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Lead	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Manganese (in sediment or water)	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Manganese (in food)	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Mercury	0.00E+00			0.00E+00	–		5E+00			5.50E+00	Yes
			Selenium	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Thallium	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Vanadium	0.00E+00			0.00E+00	–		3E-01			2.86E-01	–
			Zinc	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Chloroform	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Hexachlorocyclohexane, alpha-	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Methylene chloride	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Benz(a)anthracene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Benzo(a)pyrene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Benzo(b)fluoranthene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Benzo(k)fluoranthene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Chrysene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Dibenz(ah)anthracene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Indeno(1,2,3-cd)pyrene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Naphthalene	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			Bis(2-ethylhexyl) phthalate	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			PCB 1254	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			PCBs, total	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			DDD, p,p'-	0.00E+00			0.00E+00	–		0E+00			0.00E+00	–
			DDE, p,p'-	3.47E-07			3.47E-07	–		6E-03			5.06E-03	–
	Exposure Medium Total						6.9E-06	Yes					6.0E+00	Yes

TABLE C-34

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 10 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1

Total Risk Across all Media: 4.3E-04

Total Hazards Across all Media: 2.8E+01

Target organ across all exposure pathways: Central nervous system =	3.23E-01
Target organ across all exposure pathways: Blood =	1.02E-01
Target organ across all exposure pathways: Skin =	9.23E+00
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	4.60E-02
Target organ across all exposure pathways: Gatrointestinal System =	1.05E+01
Target organ across all exposure pathways: Immune system =	2.76E-01
Target organ across all exposure pathways: Liver =	4.05E-01
Target organ across all exposure pathways: Whole body/growth =	6.50E-02

TABLE C-35

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 10 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Subsistence
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
Fish	Fish fillet	Plow Shop Pond	Aluminum	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Antimony	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Arsenic	1.24E-04			1.24E-04	Yes		6.44E-01			6.44E-01	--
			Barium	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Cadmium (in solid media)	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Cadmium (in water)	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Chromium, total	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Copper	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Iron	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Lead	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Manganese (in sediment or water)	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Manganese (in food)	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Mercury	0.00E+00			0.00E+00	--		2.09E+01			2.09E+01	Yes
			Selenium	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Thallium	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Vanadium	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Zinc	0.00E+00			0.00E+00	--		1.09E+00			1.09E+00	Yes
			Chloroform	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Hexachlorocyclohexane, alpha-	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Methylene chloride	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Benz(a)anthracene	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Benzo(a)pyrene	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Benzo(b)fluoranthene	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Benzo(k)fluoranthene	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Chrysene	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Dibenz(ah)anthracene	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Indeno(1,2,3-cd)pyrene	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Naphthalene	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			Bis(2-ethylhexyl) phthalate	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			PCB 1254	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			PCBs, total	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			DDD, p,p'-	0.00E+00			0.00E+00	--		0.00E+00			0.00E+00	--
			DDE, p,p'-	6.61E-06			6.61E-06	Yes		2.27E-02			2.27E-02	--
	Exposure Medium Total						1.3E-04	Yes					2.3E+01	Yes

Target organ across all exposure pathways: Central nervous system =	0.00E+00
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	6.44E-01
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	0.00E+00
Target organ across all exposure pathways: Gastrointestinal System =	0.00E+00
Target organ across all exposure pathways: Immune system =	2.09E+01
Target organ across all exposure pathways: Liver =	2.27E-02
Target organ across all exposure pathways: Whole body/growth =	1.09E+00

TABLE C-36

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

RAGS TABLE 10 RME

FORT DEVENS, PLOW SHOP AND GROVE PONDS, MASSACHUSETTS

Scenario Timeframe: Current
Receptor Population: Subsistence
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1E-6	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total	greater than 1
Fish	Fish fillet	Plow Shop Pond	Aluminum	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Antimony	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Arsenic	4.34E-05			4.34E-05	Yes		2.25E-01			2.25E-01	–
			Barium	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Cadmium (in solid media)	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Cadmium (in water)	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Chromium, total	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Copper	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Iron	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Lead	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Manganese (in sediment or wate	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Manganese (in food)	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Mercury	0.00E+00			0.00E+00	–		7.32E+00			7.32E+00	Yes
			Selenium	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Thallium	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Vanadium	0.00E+00			0.00E+00	–		3.81E-01			3.81E-01	–
			Zinc	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Chloroform	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Hexachlorocyclohexane, alpha-	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Methylene chloride	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Benz(a)anthracene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Benzo(a)pyrene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Benzo(b)fluoranthene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Benzo(k)fluoranthene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Chrysene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Dibenz(ah)anthracene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Indeno(1,2,3-cd)pyrene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Naphthalene	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			Bis(2-ethylhexyl) phthalate	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			PCB 1254	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			PCBs, total	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			DDD, p,p'-	0.00E+00			0.00E+00	–		0.00E+00			0.00E+00	–
			DDE, p,p'-	2.31E-06			2.31E-06	Yes		7.93E-03			7.93E-03	–
	Exposure Medium Total						4.6E-05	Yes					7.9E+00	Yes

Target organ across all exposure pathways: Central nervous system =	0.00E+00
Target organ across all exposure pathways: Blood =	0.00E+00
Target organ across all exposure pathways: Skin =	2.25E-01
Target organ across all exposure pathways: Cardiovascular system =	0.00E+00
Target organ across all exposure pathways: Kidney =	0.00E+00
Target organ across all exposure pathways: Gatrointestinal System =	0.00E+00
Target organ across all exposure pathways: Immune system =	7.32E+00
Target organ across all exposure pathways: Liver =	7.93E-03
Target organ across all exposure pathways: Whole body/growth =	3.81E-01

APPENDIX D

TABLE D-1
RAGS D ADULT LEAD WORKSHEET
Site Name: Ft. Devens, Grove Pond
Receptor: Adult Non-Resident Recreational, Exposure to Sediment

1. Lead Screening Questions

Medium	Lead Concentration used in Model Run		Basis for Lead Concentration Used For Model Run	Lead Screening Concentration		Basis for Lead Screening Level
	Value	Units		Value	Units	
Soil	227	mg/kg	Arithmetic mean	400	mg/kg	Recommended Soil Screening Level for Residential receptor

2. Lead Model Questions

Question	Response
What lead model was used? Provide reference and version	Adult Lead Model dated 5/19/03
If the EPA Adult Lead Model (ALM) was not used provide rationale for model selected.	NA
Where are the input values located in the risk assessment report?	Input values are located in RAGS D Table 3 for EPC and RAGS D Table 4s for exposure factors
What statistics were used to represent the exposure concentration terms and where are the data on concentrations in the risk assessment that support use of these statistics?	Arithmetic Mean. Data are Located in this Appendix
What was the point of exposure and location?	Grove Pond- Near-Shore Sediment
Where are the output values located in the risk assessment report?	Located in this Appendix
What GSD value was used? If this is outside the recommended range of 1.8-2.1), provide rationale in Appendix <Y>.	GSD = 2.3 which is the currently recommended GSD for heterogeneous populations
What baseline blood lead concentration (PbB_0) value was used? If this is outside the default range of 1.7 to 2.2 provide rationale in Appendix <Y>	PbB0 = 1.7, This is the current model default
Was the default exposure frequency (EF; 219 days/year) used?	No, EF = 65 days/year but note that AT = 152 days. Guidance on intermittent exposure to lead states that exposure should not be annualized. Therefore exposure for the 5 month exposure period of May to September (equal to 152 days) was used as the AT.
Was the default BKSF used (0.4 ug/dL per ug/day) used?	Yes
Was the default absorption fraction (AF; 0.12) used?	Yes
Was the default soil ingestion rate (IR; 50 mg/day) used?	No. The default value for the residential adult was used equal to 100 mg/day. See RAGS D Table 4s
If non-default values were used for any of the parameters listed above, where are the rationale for the values located in the risk assessment report?	See RAGS D Table 4s

3. Final Result

Medium	Result	Comment/RBRG [1]
Soil	Input value of 227 ppm in sediment results in 2.5% of receptors above a blood lead level of 10 ug/d and geometric mean blood lead = 2.2 ug/dL. This does not exceed the blood lead goal as described in the 1994 OSWER Directive of no more than 5% of children (fetuses of exposed women) exceeding 10 ug/dL blood lead.	No RBRG was required because risks were not found to be higher than the action level.

1. Attach the ALM spreadsheet output file upon which the Risk Based Remediation Goal (RBRG) was based and description of rationale for parameters used. For additional information, see www.epa.gov/superfund/programs/lead

TABLE D-1 BACKUP
GROVE POND
SEDIMENT

Calculations of Blood Lead Concentrations (PbBs)

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 05/19/03

Exposure Variable	PbB Equation[1] 1*	2**	Description of Exposure Variable	Units	Values for Non-Residential Exposure Scenario: Using Equation 1: GSDi = Hom	Using Equation 1: GSDi = Het	Using Equation 2: GSDi = Hom	Using Equation 2: GSDi = Het
PbS	X	X	Soil lead concentration	ug/g or ppm		227		
$R_{fetal/maternal}$	X	X	Fetal/maternal PbB ratio	--		0.9		
BKSF	X	X	Biokinetic Slope Factor	ug/dL per ug/day		0.4		
GSD_i	X	X	Geometric standard deviation PbB	--		2.3		
PbB_0	X	X	Baseline PbB	ug/dL		1.7		
IR_S	X		Soil ingestion rate (including soil-derived indoor dust)	g/day		0.100		
IR_{S+D}		X	Total ingestion rate of outdoor soil and indoor dust	g/day		--		
W_S		X	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--		--		
K_{SD}		X	Mass fraction of soil in dust	--		--		
$AF_{S, D}$	X	X	Absorption fraction (same for soil and dust)	--		0.12		
$EF_{S, D}$	X	X	Exposure frequency (same for soil and dust)	days/yr		65		
$AT_{S, D}$	X	X	Averaging time (same for soil and dust)	days/yr		152		
PbB_{adult}			**PbB of adult worker, geometric mean**	**ug/dL**		**2.2**		
$PbB_{fetal, 0.95}$			**95th percentile PbB among fetuses of adult workers**	**ug/dL**		**7.7**		
PbB_t			**Target PbB level of concern (e.g., 10 ug/dL)**	**ug/dL**		**10.0**		
$P(PbB_{fetal} > PbB_t)$			**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**		**2.5%**		

[1] Equation 1 does not apportion exposure between soil and dust ingestion (excludes W_S, K_{SD}).
When $IR_S = IR_{S+D}$ and $W_S = 1.0$, the equations yield the same $PbB_{fetal,0.95}$.

***Equation 1, based on Eq. 1, 2 in USEPA (1996).**

PbB_{adult} =	$(PbS*BKSF*IR_{S+D}*AF_{S,D}*EF_S/AT_{S,D}) + PbB_0$
$PbB_{fetal, 0.95}$ =	$PbB_{adult} * (GSD_i^{1.645} * R)$

****Equation 2, alternate approach based on Eq. 1, 2, and A-19 in USEPA (1996).**

PbB_{adult} =	$PbS*BKSF*([(IR_{S+D})*AF_S*EF_S*W_S]+[K_{SD}*(IR_{S+D})*(1-W_S)*AF_D*EF_D])/365+PbB_0$
$PbB_{fetal, 0.95}$ =	$PbB_{adult} * (GSD_i^{1.645} * R)$

Source: U.S. EPA (1996). Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

TABLE D-2
RAGS D ADULT LEAD WORKSHEET
Site Name: Ft. Devens, Plow Shop Pond
Receptor: Adult Non-Resident Recreational, Exposure to Sediment

1. Lead Screening Questions

Medium	Lead Concentration used in Model Run		Basis for Lead Concentration Used For Model Run	Lead Screening Concentration		Basis for Lead Screening Level
	Value	Units		Value	Units	
Soil	124	mg/kg	Arithmetic mean	400	mg/kg	Recommended Soil Screening Level for Residential receptor

2. Lead Model Questions

Question	Response
What lead model was used? Provide reference and version	Adult Lead Model dated 5/19/03
If the EPA Adult Lead Model (ALM) was not used provide rationale for model selected.	NA
Where are the input values located in the risk assessment report?	Input values are located in RAGS D Table 3 for EPC and RAGS D Table 4s for exposure factors
What statistics were used to represent the exposure concentration terms and where are the data on concentrations in the risk assessment that support use of these statistics?	Arithmetic Mean. Data are Located in This Appendix
What was the point of exposure and location?	Grove Pond- Near-Shore Sediment
Where are the output values located in the risk assessment report?	Located in this Appendix
What GSD value was used? If this is outside the recommended range of 1.8-2.1), provide rationale in Appendix <Y>.	GSD = 2.3 which is the currently recommended GSD for heterogeneous populations
What baseline blood lead concentration (PbB_0) value was used? If this is outside the default range of 1.7 to 2.2 provide rationale in Appendix <Y>	PbB0 = 1.7, This is the current model default
Was the default exposure frequency (EF; 219 days/year) used?	No, EF = 65 days/year but note that AT = 152 days. Guidance on intermittent exposure to lead states that exposure should not be annualized. Therefore exposure for the 5 month exposure period of May to September (equal to 152 days) was used as the AT.
Was the default BKSF used (0.4 ug/dL per ug/day) used?	Yes
Was the default absorption fraction (AF; 0.12) used?	Yes
Was the default soil ingestion rate (IR; 50 mg/day) used?	No. The default value for the residential adult was used equal to 100 mg/day. See RAGS D Table 4s
If non-default values were used for any of the parameters listed above, where are the rationale for the values located in the risk assessment report?	See RAGS D Table 4s

3. Final Result

Medium	Result	Comment/RBRG [1]
Sediment	Input value of 124 ppm in sediment results in 1.8% of receptors above a blood lead level of 10 ug/d and geometric mean blood lead = 2.0 ug/dL. This does not exceed the blood lead goal as described in the 1994 OSWER Directive of no more than 5% of children (fetuses of exposed women) exceeding 10 ug/dL blood lead.	No RBRG was required because risks were not found to be higher than the action level.

1. Attach the ALM spreadsheet output file upon which the Risk Based Remediation Goal (RBRG) was based and description of rationale for parameters used. For additional information, see www.epa.gov/superfund/programs/lead

TABLE D-2 BACKUP
PLOW SHOP POND
SEDIMENT

Calculations of Blood Lead Concentrations (PbBs)

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 05/19/03

Exposure Variable	PbB Equation[1] 1*	PbB Equation[1] 2**	Description of Exposure Variable	Units	Values for Non-Residential Exposure Scenario: Using Equation 1, GSDi = Hom	Using Equation 1, GSDi = Het	Using Equation 2, GSDi = Hom	Using Equation 2, GSDi = Het
PbS	X	X	Soil lead concentration	ug/g or ppm		124		
$R_{fetal/maternal}$	X	X	Fetal/maternal PbB ratio	--		0.9		
BKSF	X	X	Biokinetic Slope Factor	ug/dL per ug/day		0.4		
GSD_i	X	X	Geometric standard deviation PbB	--		2.3		
PbB_0	X	X	Baseline PbB	ug/dL		1.7		
IR_S	X		Soil ingestion rate (including soil-derived indoor dust)	g/day		0.100		
IR_{S+D}		X	Total ingestion rate of outdoor soil and indoor dust	g/day		--		
W_S		X	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--		--		
K_{SD}		X	Mass fraction of soil in dust	--		--		
$AF_{S,D}$	X	X	Absorption fraction (same for soil and dust)	--		0.12		
$EF_{S,D}$	X	X	Exposure frequency (same for soil and dust)	days/yr		65		
$AT_{S,D}$	X	X	Averaging time (same for soil and dust)	days/yr		152		
PbB_{adult}			**PbB of adult worker, geometric mean**	**ug/dL**		**2.0**		
$PbB_{fetal,0.95}$			**95th percentile PbB among fetuses of adult workers**	**ug/dL**		**6.9**		
PbB_t			**Target PbB level of concern (e.g., 10 ug/dL)**	**ug/dL**		**10.0**		
$P(PbB_{fetal} > PbB_t)$			**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**		**1.8%**		

[1] Equation 1 does not apportion exposure between soil and dust ingestion (excludes W_S, K_{SD}).
When $IR_S = IR_{S+D}$ and $W_S = 1.0$, the equations yield the same $PbB_{fetal,0.95}$.

***Equation 1, based on Eq. 1, 2 in USEPA (1996).**

PbB_{adult} =	$(PbS*BKSF*IR_{S+D}*AF_{S,D}*EF_S/AT_{S,D}) + PbB_0$
$PbB_{fetal,0.95}$ =	$PbB_{adult} * (GSD_i^{1.645} * R)$

****Equation 2, alternate approach based on Eq. 1, 2, and A-19 in USEPA (1996).**

PbB_{adult} =	$PbS*BKSF*([(IR_{S+D})*AF_S*EF_S*W_S]+[K_{SD}*(IR_{S+D})*(1-W_S)*AF_D*EF_D])/365+PbB_0$
$PbB_{fetal,0.95}$ =	$PbB_{adult} * (GSD_i^{1.645} * R)$

TABLE D-3
RAGS D IEUBK LEAD WORKSHEET
Site Name: Ft. Devens, Grove Pond
Receptor: Recreational Child Exposure to Sediment, Surface Water and Fish

1. Lead Screening Questions

Medium	Lead Concentration Used in Model Run		Basis for Lead Concentration Used For Model Run	Lead Screening Concentration		Basis for Lead Screening Level
	Value	Units		Value	Units	
Sediment	227	mg/kg	Average Detected Value	400	mg/kg	Recommended Soil Screening Level
Water	used drinking water default	ug/L	Average Detected Value	15	ug/L	Recommended Drinking Water Action Level

2. Lead Model Questions

Question	Response for Residential Lead Model
What lead model (version and date) was used?	Model Version: 1.0 Build 261
Where are the input values located in the risk assessment report?	EPCs are in RAGS D Table 3s, Exposure Factors are in RAGS D Table 4s
What range of media concentrations were used for the model?	Sediment- used arithmetic mean Surface water- EPC was less than default for drinking water so used default value Fish Tissue- used arithmetic mean of fillet data from Grove Pond fish
What statistics were used to represent the exposure concentration terms and where are the data on concentrations in the risk assessment that support use of these statistics?	Arithmetic mean. EPC data are in RAGS D Table 3s
Was soil sample taken from top 2 cm? If not, why?	Not Applicable
Was soil sample sieved? What size screen was used? If not sieved, provide rationale.	Not Applicable
What was the point of exposure/location?	Grove Pond
Where are the output values located in the risk assessment report?	Located in Appendix __
Was the model run using default values only?	No. Site specific EPCs were used for sediment. Fish tissue was included by assuming that 41 out of 273 meat meals or 15% of meat meals consisted of Grove Pond fish. This was derived from assuming that recreational child consume one meal of Grove Pond caught fish per week for 9 temperate months of the year (39 weeks).
Was the default soil bioavailability used?	Yes. Default is 30%
Was the default soil ingestion rate used?	Yes. Default values for 7 age groups are 85, 135, 135, 100, 090, and 85 mg/day
If non-default values were used, where are the rationale for the values located in the risk assessment report?	Located in this table and RAGS Table 4s

1. Attach the IEUBK text output file and graph upon which the PRG was based as an appendix. For additional information, see www.epa.gov/superfund/programs/lead

1. Attach the IEUBK text output file and graph upon which the PRG was based as an appendix. For additional information, see www.epa.gov/superfund/programs/lead

3. Final Result

Medium	Result	Comment/PRG [1]
Grove Pond Sediment, Surface water, and fish	Input values from sediment, surface water and fish resulted in 2.822% of child recreational receptors above a blood lead level of 10 ug/dL. Geometric mean blood lead = 4.080 ug/dL. This does not exceed the blood lead goal as described in the 1994 OSWER Directive of no more than 5% of children exceeding 10 ug/dL blood lead.	No PRG has been developed for this site.

1. Attach the IEUBK text output file and graph upon which the PRG was based as an appendix. For additional information, see www.epa.gov/superfund/programs/lead

TABLE D-3 BACKUP
Grove Pond
LEAD MODEL FOR WINDOWS Version 1.0

==

Model Version: 1.0 Build 261
User Name:
Date: September 2005
Site Name: Grove Pond/Plow Shop Pond
Operable Unit: Grove Pond
Run Mode: Research- Recreational child

==

The time step used in this model run: 1 - Every 4 Hours (6 times a day).

****** Air ******

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Age	Time Outdoors (hours)	Ventilation Rate (m^3/day)	Lung Absorption (%)	Outdoor Air Pb Conc (ug Pb/m^3)
.5-1	1.000	2.000	32.000	0.100
1-2	2.000	3.000	32.000	0.100
2-3	3.000	5.000	32.000	0.100
3-4	4.000	5.000	32.000	0.100
4-5	4.000	5.000	32.000	0.100
5-6	4.000	7.000	32.000	0.100
6-7	4.000	7.000	32.000	0.100

****** Diet ******

Age	Diet Intake(ug/day)
.5-1	6.729
1-2	8.446
2-3	9.542
3-4	9.487
4-5	9.442
5-6	9.954
6-7	10.933

Alternative Dietary Values

Home grown fruits concentration: 0.000 ug/g
Home grown vegetables concentration: 0.000 ug/g
Fish from fishing concentration: 0.200 ug/g
Game animals from hunting concentration: 0.000 ug/g
Home grown fruits factor: 0.000 % of all fruits
Home grown vegetables factor: 0.000 % of all vegetables
Fish from fishing factor: 15.000 %of all meat
Game animals from hunting factor: 0.000 % of all meat

****** Drinking Water ******

Water Consumption:

Age	Water (L/day)
.5-1	0.200
1-2	0.500
2-3	0.520
3-4	0.530
4-5	0.550
5-6	0.580
6-7	0.590

Drinking Water Concentration: 4.000 ug Pb/L

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 168.900 ug/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
.5-1	227.000	168.900
1-2	227.000	168.900
2-3	227.000	168.900
3-4	227.000	168.900
4-5	227.000	168.900
5-6	227.000	168.900
6-7	227.000	168.900

****** Alternate Intake ******

Age	Alternate (ug Pb/day)
.5-1	0.000
1-2	0.000
2-3	0.000
3-4	0.000
4-5	0.000
5-6	0.000
6-7	0.000

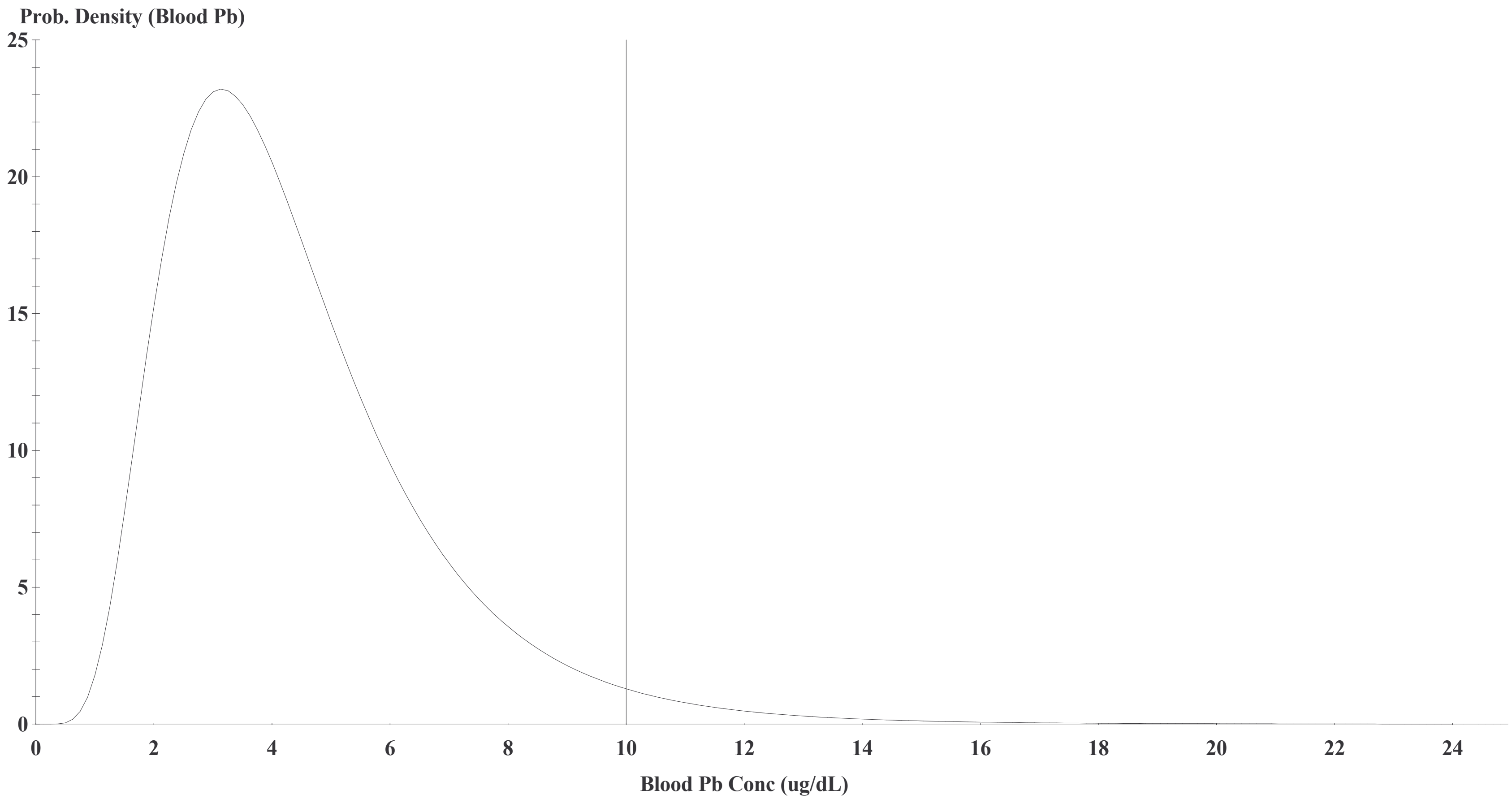
****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 2.500 ug Pb/dL

****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (ug/day)	Diet (ug/day)	Alternate (ug/day)	Water (ug/day)
.5-1	0.021	3.071	0.000	0.365
1-2	0.034	3.804	0.000	0.901
2-3	0.062	4.345	0.000	0.947
3-4	0.067	4.376	0.000	0.978
4-5	0.067	4.444	0.000	1.036
5-6	0.093	4.722	0.000	1.100
6-7	0.093	5.203	0.000	1.123

Year	Soil+Dust (ug/day)	Total (ug/day)	Blood (ug/dL)
.5-1	4.539	7.996	4.3
1-2	7.115	11.855	4.9
2-3	7.193	12.547	4.6
3-4	7.286	12.706	4.4
4-5	5.508	11.055	3.8
5-6	4.996	10.912	3.4
6-7	4.734	11.153	3.2



Cutoff = 10.000 ug/dl
Geo Mean = 4.080
GSD = 1.600
% Above = 2.822
% Below = 97.178

Age Range = 0 to 84 months
Time Step = Every 4 Hours
Run Mode = Research
Comment = Grove Pond- Rec Child

TABLE D-4
RAGS D IEUBK LEAD WORKSHEET
Site Name: Ft. Devens, Grove Pond
Receptor: Subsistence Child Exposure to Sediment, Surface Water and Fish

1. Lead Screening Questions

Medium	Lead Concentration Used in Model Run		Basis for Lead Concentration Used For Model Run	Lead Screening Concentration		Basis for Lead Screening Level
	Value	Units		Value	Units	
Sediment	227	mg/kg	Average Detected Value	400	mg/kg	Recommended Soil Screening Level
Water	used drinking water default	ug/L	Average Detected Value	15	ug/L	Recommended Drinking Water Action Level

2. Lead Model Questions

Question	Response for Residential Lead Model
What lead model (version and date) was used?	Model Version: 1.0 Build 261
Where are the input values located in the risk assessment report?	EPCs are in RAGS D Table 3s, Exposure Factors are in RAGS D Table 4s
What range of media concentrations were used for the model?	Sediment- used arithmetic mean Surface water- EPC was less than default for drinking water so used default value Fish Tissue- used arithmetic mean of fillet data from Grove Pond fish
What statistics were used to represent the exposure concentration terms and where are the data on concentrations in the risk assessment that support use of these statistics?	Arithmetic mean. EPC data are in RAGS D Table 3s
Was soil sample taken from top 2 cm? If not, why?	Not Applicable
Was soil sample sieved? What size screen was used? If not sieved, provide rationale.	Not Applicable
What was the point of exposure/location?	Grove Pond
Where are the output values located in the risk assessment report?	Located in Appendix __
Was the model run using default values only?	No. Site specific EPCs were used for sediment. Fish tissue was included by assuming that 273 out of 273 meat meals or 100% of meat meals consisted of Grove Pond fish. This was derived from assuming that the subsistence child angler consumes seven meals of Grove Pond caught fish per week for 9 temperate months of the year (39 weeks).
Was the default soil bioavailability used?	Yes. Default is 30%
Was the default soil ingestion rate used?	Yes. Default values for 7 age groups are 85, 135, 135, 100, 090, and 85 mg/day
If non-default values were used, where are the rationale for the values located in the risk assessment report?	Located in this table and RAGS Table 4s

1. Attach the IEUBK text output file and graph upon which the PRG was based as an appendix. For additional information, see www.epa.gov/superfund/programs/lead

1. Attach the IEUBK text output file and graph upon which the PRG was based as an appendix. For additional information, see www.epa.gov/superfund/programs/lead

3. Final Result

Medium	Result	Comment/PRG [1]
Grove Pond Sediment, Surface water, and fish	Input values from sediment, surface water and fish resulted in 14.973% of child subsistence angler receptors above a blood lead level of 10 ug/dL. Geometric mean blood lead = 6.141 ug/dL. This exceeds the blood lead goal as described in the 1994 OSWER Directive of no more than 5% of children exceeding 10 ug/dL blood lead.	No PRG has been developed for this site. This analysis was performed for EPA for informational purposes only.

1. Attach the IEUBK text output file and graph upon which the PRG was based as an appendix. For additional information, see www.epa.gov/superfund/programs/lead

TABLE D-4 BACKUP
Grove Pond
LEAD MODEL FOR WINDOWS Version 1.0

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Model Version: 1.0 Build 261
User Name:
Date: September 2005
Site Name: Grove Pond/Plow Shop Pond
Operable Unit: Grove Pond
Run Mode: Research- Subsistence angler child

==

****** Air ******

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Age	Time Outdoors (hours)	Ventilation Rate (m^3/day)	Lung Absorption (%)	Outdoor Air Pb Conc (ug Pb/m^3)
.5-1	1.000	2.000	32.000	0.100
1-2	2.000	3.000	32.000	0.100
2-3	3.000	5.000	32.000	0.100
3-4	4.000	5.000	32.000	0.100
4-5	4.000	5.000	32.000	0.100
5-6	4.000	7.000	32.000	0.100
6-7	4.000	7.000	32.000	0.100

****** Diet ******

Age	Diet Intake(ug/day)
.5-1	11.560
1-2	22.781
2-3	25.122
3-4	26.014
4-5	26.915
5-6	28.129
6-7	30.509

Alternative Dietary Values
Home grown fruits concentration: 0.000 ug/g
Home grown vegetables concentration: 0.000 ug/g

Fish from fishing concentration: 0.200 ug/g
Game animals from hunting concentration: 0.000 ug/g
Home grown fruits factor: 0.000 % of all fruits
Home grown vegetables factor: 0.000 % of all vegetables
Fish from fishing factor: 100.000 %of all meat
Game animals from hunting factor: 0.000 % of all meat

****** Drinking Water ******

Water Consumption:

Age	Water (L/day)
.5-1	0.200
1-2	0.500
2-3	0.520
3-4	0.530
4-5	0.550
5-6	0.580
6-7	0.590

Drinking Water Concentration: 4.000 ug Pb/L

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 168.900 ug/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
.5-1	227.000	168.900
1-2	227.000	168.900
2-3	227.000	168.900
3-4	227.000	168.900
4-5	227.000	168.900
5-6	227.000	168.900
6-7	227.000	168.900

****** Alternate Intake ******

Age	Alternate (ug Pb/day)

.5-1	0.000
1-2	0.000
2-3	0.000
3-4	0.000
4-5	0.000
5-6	0.000
6-7	0.000

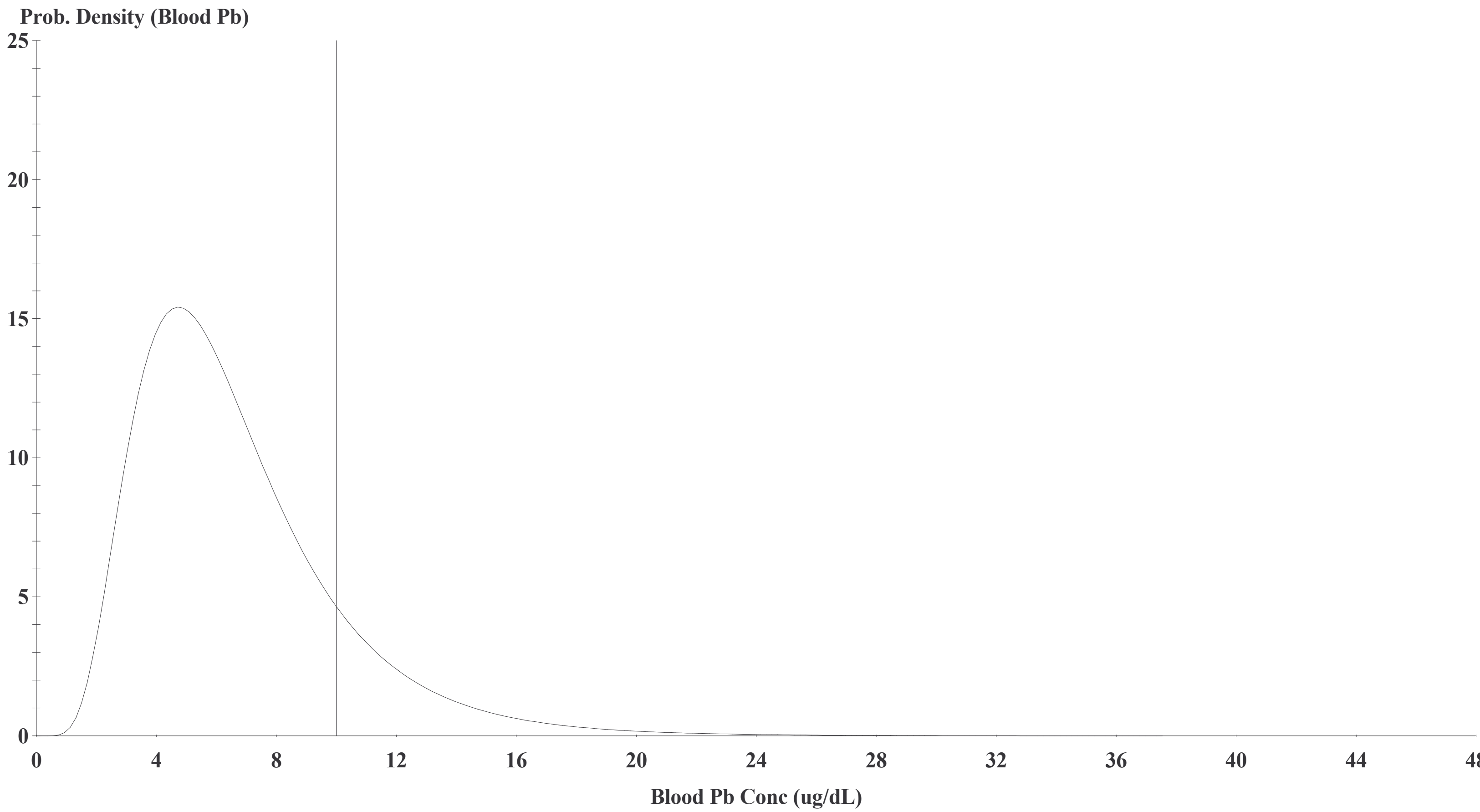
****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 2.500 ug Pb/dL

****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (ug/day)	Diet (ug/day)	Alternate (ug/day)	Water (ug/day)
.5-1	0.021	5.155	0.000	0.357
1-2	0.034	9.754	0.000	0.856
2-3	0.062	10.905	0.000	0.903
3-4	0.067	11.478	0.000	0.935
4-5	0.067	12.151	0.000	0.993
5-6	0.093	12.831	0.000	1.058
6-7	0.093	13.966	0.000	1.080

Year	Soil+Dust (ug/day)	Total (ug/day)	Blood (ug/dL)
.5-1	4.436	9.968	5.4
1-2	6.764	17.409	7.0
2-3	6.858	18.729	6.9
3-4	6.971	19.451	6.7
4-5	5.283	18.493	6.2
5-6	4.804	18.787	5.8
6-7	4.553	19.693	5.5



Cutoff = 10.000 ug/dl
Geo Mean = 6.141
GSD = 1.600
% Above = 14.973
% Below = 85.027

Age Range = 0 to 84 months
Time Step = Every 4 Hours
Run Mode = Research
Comment = Grove Pond-Subsist ChildAngler

TABLE D-5
RAGS D IEUBK LEAD WORKSHEET
Site Name: Ft. Devens, Plow Shop Pond
Receptor:Recreational Child Exposure to Sediment and Surface Water

1. Lead Screening Questions

Medium	Lead Concentration Used in Model Run		Basis for Lead Concentration Used For Model Run	Lead Screening Concentration		Basis for Lead Screening Level
	Value	Units		Value	Units	
Sediment	used model default	mg/kg	Average Detected Value	400	mg/kg	Recommended Soil Screening Level
Surface Water	used model default	ug/L	Average Detected Value	15	ug/L	Recommended Drinking Water Action Level

2. Lead Model Questions

Question	Response for Residential Lead Model
What lead model (version and date) was used?	Model Version: 1.0 Build 261
Where are the input values located in the risk assessment report?	EPCs are in RAGS D Table 3s, Exposure Factors are in RAGS D Table 4s
What range of media concentrations were used for the model?	Sediment- EPC was less than the default for soil expousre Surface water- EPC was less than default for drinking water so used default value Fish- lead in fish tissue was not a COPC for Plow Shop Pond fish
What statistics were used to represent the exposure concentration terms and where are the data on concentrations in the risk assessment that support use of these statistics?	Not Applicable
Was soil sample taken from top 2 cm? If not, why?	Not Applicable
Was soil sample sieved? What size screen was used? If not sieved, provide rationale.	Not Applicable
What was the point of exposure/location?	Plow Shop Pond
Where are the output values located in the risk assessment report?	Located in Appendix __
Was the model run using default values only?	Yes
Was the default soil bioavailability used?	Yes Default is 30%
Was the default soil ingestion rate used?	Yes Default values for 7 age groups are 85, 135, 135, 100, 090, and 85 mg/day
If non-default values were used, where are the rationale for the values located in the risk assessment report?	Located in this table and RAGS Table 4s

1. Attach the IEUBK text output file and graph upon which the PRG was based as an appendix. For additional information, see www.epa.gov/superfund/programs/lead

3. Final Result

Medium	Result	Comment/PRG [1]
Plow Shop Pond Sediment, Surface water,	Input values from sediment, and surface water resulted in 1.101% of recreational children above a blood lead level of 10 ug/dL. Geometric mean blood lead = 3.409 ug/dL. This does not exceed the blood lead goal as described in the 1994 OSWER Directive of no more than 5% of children exceeding 10 ug/dL blood lead.	No PRGs have been developed for this site.

1. Attach the IEUBK text output file and graph upon which the PRG was based as an appendix. For additional information, see www.epa.gov/superfund/programs/lead

TABLE D-5 BACKUP
Plow Shop Pond
LEAD MODEL FOR WINDOWS Version 1.0

==

Model Version: 1.0 Build 261
User Name:
Date: September 2005
Site Name: Grove Pond/Plow Shop Pond
Operable Unit: Plow Shop Pond
Run Mode: Research- Recreational Child

==

The time step used in this model run: 1 - Every 4 Hours (6 times a day).

****** Air ******

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Age	Time Outdoors (hours)	Ventilation Rate (m^3/day)	Lung Absorption (%)	Outdoor Air Pb Conc (ug Pb/m^3)
.5-1	1.000	2.000	32.000	0.100
1-2	2.000	3.000	32.000	0.100
2-3	3.000	5.000	32.000	0.100
3-4	4.000	5.000	32.000	0.100
4-5	4.000	5.000	32.000	0.100
5-6	4.000	7.000	32.000	0.100
6-7	4.000	7.000	32.000	0.100

****** Diet ******

Age	Diet Intake(ug/day)
.5-1	5.530
1-2	5.780
2-3	6.490
3-4	6.240
4-5	6.010
5-6	6.340
6-7	7.000

****** Drinking Water ******

Water Consumption:

Age	Water (L/day)
.5-1	0.200
1-2	0.500
2-3	0.520
3-4	0.530
4-5	0.550
5-6	0.580
6-7	0.590

Drinking Water Concentration: 4.000 ug Pb/L

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 150.000 ug/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
.5-1	200.000	150.000
1-2	200.000	150.000
2-3	200.000	150.000
3-4	200.000	150.000
4-5	200.000	150.000
5-6	200.000	150.000
6-7	200.000	150.000

****** Alternate Intake ******

Age	Alternate (ug Pb/day)
.5-1	0.000
1-2	0.000
2-3	0.000
3-4	0.000
4-5	0.000
5-6	0.000
6-7	0.000

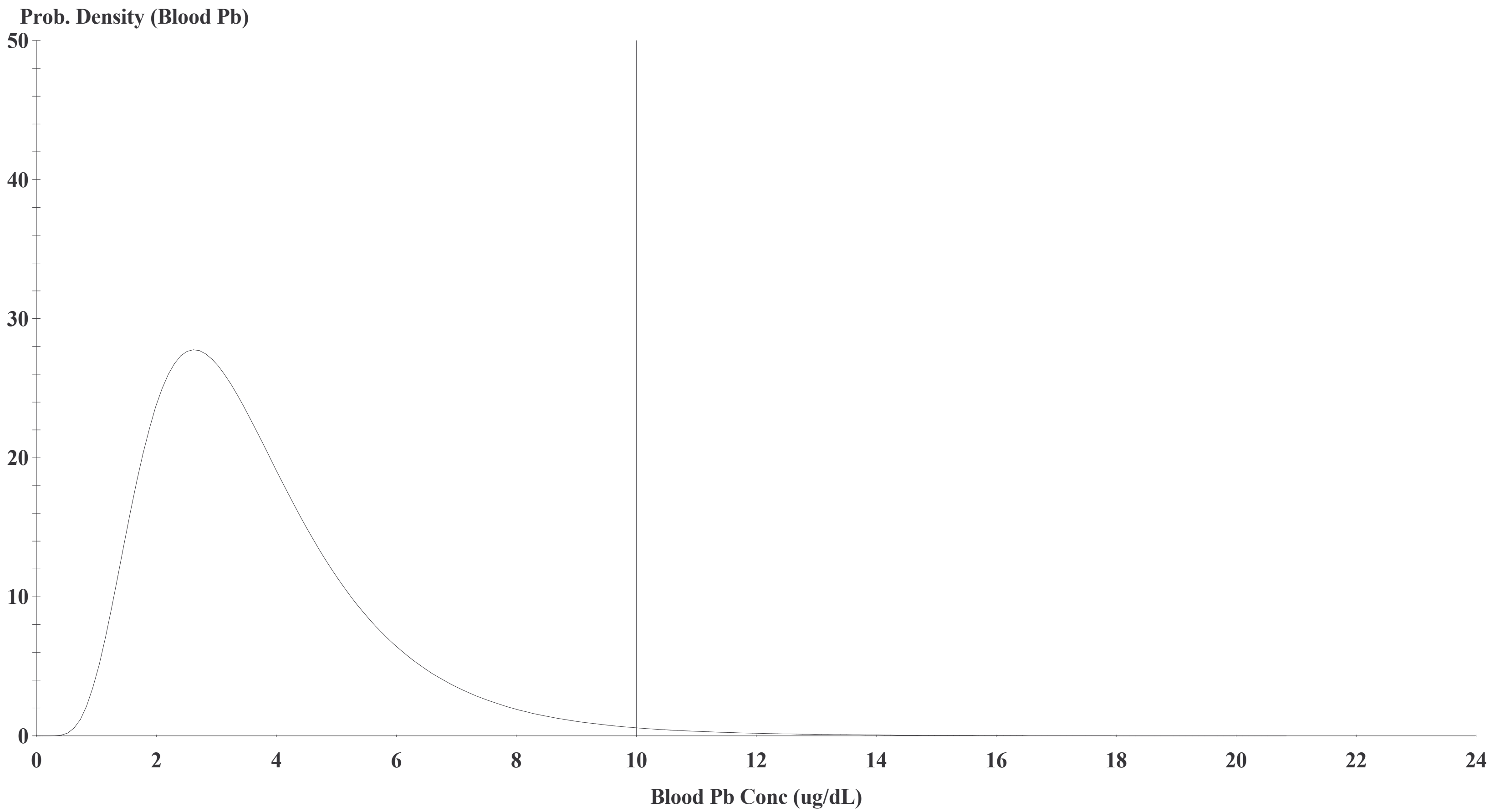
****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 2.500 ug Pb/dL

****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (ug/day)	Diet (ug/day)	Alternate (ug/day)	Water (ug/day)
.5-1	0.021	2.553	0.000	0.369
1-2	0.034	2.647	0.000	0.916
2-3	0.062	3.002	0.000	0.962
3-4	0.067	2.919	0.000	0.992
4-5	0.067	2.863	0.000	1.048
5-6	0.093	3.040	0.000	1.112
6-7	0.093	3.366	0.000	1.135

Year	Soil+Dust (ug/day)	Total (ug/day)	Blood (ug/dL)
.5-1	4.061	7.004	3.8
1-2	6.399	9.997	4.2
2-3	6.462	10.488	3.9
3-4	6.536	10.514	3.7
4-5	4.930	8.908	3.1
5-6	4.467	8.712	2.7
6-7	4.231	8.826	2.5



Cutoff = 10.000 ug/dl
Geo Mean = 3.409
GSD = 1.600
% Above = 1.101
% Below = 98.899

Age Range = 0 to 84 months
Time Step = Every 4 Hours
Run Mode = Research
Comment = Plow Shop Pond- Rec Child

FINAL

BASELINE ECOLOGICAL RISK ASSESSMENT

GROVE POND AND PLOW SHOP POND

AYER, MASSACHUSETTS

May 2006

Prepared for:

USEPA Region 1
Contract EP-W-05-020 Task Order #01

Prepared by:

Gannett Fleming, Inc.
199 Wells Avenue, Suite 210
Newton, MA 02459

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Acronyms used in the Baseline Ecological Risk Assessment

AUF	Area Use Factor
AVS	Acid Volatile Sulfide
BAF	Bioaccumulation Factor
BERA	Baseline Ecological Risk Assessment
BSAF	Biota-Sediment Accumulation Factor
CCC	Criterion Continuous Concentration
COPC	Chemical of Potential Concern
CSM	Conceptual Site Model
CBR	Critical Body Residue
DDD	Dichloro-diphenyl-dichloroethane
DDE	Dichloro-diphenyl-dichloroethylene
DDT	Dichloro-diphenyl-trichloroethane
ERED	Environmental Residue-Effects Database
ER-L	Effects Range-Low
ER-M	Effects Range-Median
FIR	Food Ingestion Rate
HQ	Hazard Quotient
EPC	Exposure Point Concentration
ESI	Expanded Site Investigation
EU	Exposure Unit
LEL	Low-Effects Level
LOAEL	Lowest Observed Adverse Effects Level
MADEP	Massachusetts Department of Environmental Protection
MOU	Memorandum of Understanding
NAWQC	National Ambient Water Quality Criteria
NOAA	National Oceanic and Atmospheric Administration
NOAEL	No Observed Adverse Effects Level
NPL	National Priorities List
ORNL	Oak Ridge National Laboratory
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PDC	Plastic Distributing Company
PEC	Probable Effects Concentration
PRE	Preliminary Risk Evaluation
PUF	Plant Uptake Factor
QA/QC	Quality Assurance/Quality Control
RR	Residual Risk
SAV	Secondary Acute Value
SCV	Secondary Chronic Value
SEL	Severe-Effects Level
SEM	Simultaneously Extracted Metals
SQB	Sediment Quality Benchmark
SVOC	Semivolatile Organic Carbon

TDD	Total Daily Dose
TEC	Threshold Effects Concentration
TRV	Toxicity Reference Value
UCL	Upper Confidence Limit
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Carbon
WOE	Weight of Evidence

FINAL

BASELINE ECOLOGICAL RISK ASSESSMENT

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EXECUTIVE SUMMARY

E.1 GENERAL INTRODUCTION

Grove Pond and Plow Shop Pond are located in Ayer, Massachusetts, northeast of the former Fort Devens, currently referred to as Devens. Aquatic organisms in the pond and terrestrial wildlife foraging in the pond may be exposed to the reservoir of contaminants in pond sediment. Contaminants may have originated from activities at the Devens base, other localized activities (e.g. tannery and railroad activities), upgradient sources, or via atmospheric deposition.

This Baseline Ecological Risk Assessment (BERA) was conducted to provide a quantitative estimate of risk posed to ecological receptors potentially exposed to Grove Pond and Plow Shop Pond media. This BERA, which incorporates data from 1991 to 2005 collected through several different investigations in the ponds, was conducted to support the Expanded Site Investigation (ESI).

E.2 RISK ANALYSIS

E.2.1 INTRODUCTION

The conceptual site model (CSM) for Grove Pond and Plow Shop Pond identifies exposure pathways from chemicals in pond sediment, surface water, and biota to aquatic organisms and semi-aquatic wildlife foraging in the pond. Assessment and measurement endpoints were selected based on the CSM. Assessment endpoints represent the ecological resources in the ponds that are to be protected. Measurement endpoints represent quantifiable ecological characteristics that are evaluated to determine if the assessment endpoints are met.

The assessment endpoints for the receptor groups in the ponds are as follows:

- Protection of the long-term health of water column invertebrate populations sublethal and lethal acute toxic effects of chemicals in surface water.

- Protection of benthic macroinvertebrate communities from sublethal and lethal acute toxic effects of chemicals in sediments.

- Protection of the long-term health of local fish populations from sublethal and lethal toxic effects of chemicals in surface waters.

- Protection of omnivorous mammals, carnivorous birds, piscivorous mammals and birds, and insectivorous birds foraging in the pond, to insure that ingestion of chemicals in food items, sediment, and surface water does not have a negative impact on growth, survival, and reproduction.

The measurement endpoints used in this BERA to determine risk are the following:

- Comparison of surface water and sediment concentration data to literature benchmarks protective of aquatic biota.

- Surface water chronic toxicity testing using sensitive freshwater invertebrate and fish species.

- Sediment toxicity testing using sensitive invertebrate species.

- Comparison of aquatic invertebrate and fish tissue residue levels against literature Critical Body Residues (CBRs).

- Food chain modeling to estimate a daily intake for wildlife receptors foraging in the ponds; compared the daily intake with literature toxicity reference values (TRV) to calculate a hazard quotient (HQ).

A Weight of Evidence (WOE) approach was used to interpret the various findings of the risk assessment. A WOE score was given to each measurement endpoint ”low-medium” to “high ”, depending on the strength of the link between the measurement endpoint and its associated assessment endpoint. The WOE score was evaluated along with the estimation of risk for each assessment endpoint in a risk integration step. This risk integration step allowed a determination of the potential for and significance of risk to the various assessment endpoints.

Exposure units are defined in ecological risk assessment to provide an estimate of the area of exposure for a given ecological receptor and to determine how to organize the analytical data. The exposure units for this BERA were 1) Grove Pond, 2) Plow Shop Pond, and 3) Flannagan Pond, the reference site.

The HQ method was used to determine risk for ecological receptors foraging in the ponds. An HQ was calculated for each chemical of potential concern (COPC) by dividing an estimated or measured exposure or dose by a corresponding benchmark or toxicity value. Hazard quotients were determined for benchmarks comparisons, CBR comparisons, and food chain modeling. The HQ method was not used to determine risk in toxicity tests, however, which relied on statistical analyses instead.

Where applicable, potential risk to ecological receptors was determined for the background EU, using the same methods used to determine risk to Grove Pond and Plow Shop Pond receptors. A residual risk (RR) was calculated by dividing the site HQ by the background HQ. If the RR was greater than one, risk for a given COPC could not be attributed to background conditions.

E.2.2 RISK FINDINGS

The results of the risk characterization are summarized in Table ES-1 (Grove Pond) and Table ES-2 (Plow Shop Pond).

ES-1. Summary of Ecological Risks for Grove Pond

Target Receptor Group	Measurement Endpoints (Lines of Evidence)								Integrated Risk Interpretation
	Published Benchmarks		Laboratory Toxicity Testing		Tissue Residue Analyses		Food Chain Modeling		
	WOE	Risk	WOE	Risk	WOE	Risk	WOE	Risk	
water column invertebrates	L-M	L	M	N		ND		ND	Low risk; no unacceptable risk.
fish	L-M	L	M	N	M-H	L		ND	Low risk; no unacceptable risk.
benthic invertebrates	L-M	H	M-H	M	M-H	L		ND	Medium risk; unacceptable risk.
omnivorous mammals		ND		ND		ND	M-H	N	No unacceptable risk
piscivorous mammals		ND		ND		ND	M-H	N	No unacceptable risk.
carnivorous birds		ND		ND		ND	M-H	H	High risk; unacceptable risk
piscivorous birds		ND		ND		ND	M-H	N	No unacceptable risk.
insectivorous birds		ND		ND		ND	M-H	M	Medium risk; Unacceptable risk unlikely.

Shaded cells indicate that the measurement endpoint was not applicable to the assessment endpoint
WOE = weight of evidence
N=No significant risk identified; L-M = low-medium; M-H = medium-high; H = high
ND = not determined

ES-2. Summary of Ecological Risks for Plow Shop Pond

Target Receptor Group	Measurement Endpoints (Lines of Evidence)								Integrated Risk Interpretation
	Published Benchmarks		Laboratory Toxicity Testing		Tissue Residue Analyses		Food Chain Modeling		
	WOE	Risk	WOE	Risk	WOE	Risk	WOE	Risk	
water column invertebrates	L-M	L	M	N		ND		ND	Low risk; no unacceptable risk.
fish	L-M	L	M	N	M-H	L		ND	Low risk; no unacceptable risk.
benthic invertebrates	L-M	H	M-H	M	M-H	L		ND	Medium risk; unacceptable risk.
omnivorous mammals		ND		ND		ND	M-H	H	High risk; unacceptable risk
piscivorous mammals		ND		ND		ND	M-H	N	No unacceptable risk.
carnivorous birds		ND		ND		ND	M-H	H	High risk; unacceptable risk
piscivorous birds		ND		ND		ND	M-H	M	Medium risk; unacceptable risk unlikely.
insectivorous birds		ND		ND		ND	M-H	M	Medium risk; unacceptable risk unlikely.

Shaded cells indicate that the measurement endpoint was not applicable to the assessment endpoint
WOE = weight of evidence

N=No significant risk identified; L-M = low-medium; M-H = medium-high; H = high
ND = not determined

E.2.2.1 Water Column Invertebrate Community

Potential risk to water column invertebrates based on each measurement endpoint was determined to be the following:

A. Benchmark comparison: The benchmark comparison measurement endpoint was given low-medium weight because benchmarks do not identify site-specific risk but are generic in nature. The benchmark comparisons for Grove Pond and Plow Shop Pond revealed low potential risk to surface water invertebrates.

B. Toxicity testing: The toxicity testing measurement endpoint was given a medium weight. The results of the toxicity tests with *Ceriodaphnia dubia* revealed no significant toxicity for surface water invertebrates in Grove Pond and Plow Shop Pond.

Integrating these two lines of evidence, it is unlikely that surface water invertebrates in either of the ponds experience unacceptable risk from exposure to COPCs.

E.2.2.2 Benthic Macroinvertebrate Community

A. Benchmark comparison: The benchmark comparison measurement endpoint was given low-medium weight because benchmarks do not identify site-specific risk but are generic in nature. The benchmark comparisons revealed high potential risk to benthic invertebrates in Grove Pond and Plow Shop Pond.

B. Toxicity testing: The toxicity testing measurement endpoint was given a medium-high weight. Laboratory toxicity testing of three Grove Pond sediment samples using two benthic invertebrate species resulted in significant growth reductions (but no mortality) in two of the three samples. Testing of 11 Plow Shop Pond sediment samples using the same two species resulted in significant mortality and growth reductions in one sample, and significant growth reductions (but no mortality) in five additional samples.

C. CBR comparison: The CBR comparison measurement endpoint was given a medium-high weight. The results of the CBR comparison suggested low risk to benthic invertebrates from accumulated COPC in Grove Pond and Plow Shop Pond.

Integrating these results, it was concluded that toxicity testing and the CBR comparisons carried greater weight than did the comparisons to sediment benchmarks. Therefore, while benchmark exceedances alone suggested potential high risk to benthic invertebrates in both ponds, subsequent lines of evidence indicated that the exceedances did not equate to high risk. The three lines of evidence suggest that benthic invertebrates in Grove Pond were likely to experience medium risk due to potential growth reduction. Benthic invertebrates in Plow Shop Ponds were likely to experience medium risk due to reduced survival at one location and reduced growth at several other locations in the pond

E.2.2.3 Fish Community

A. Benchmark comparison: The benchmark comparison measurement endpoint was given low-medium weight because benchmarks do not identify site-specific risk but are generic in nature. The benchmark comparisons for Grove Pond and Plow Shop Pond revealed low potential risk to fish.

B. Toxicity testing: The toxicity testing measurement endpoint was given a medium weight. The results of the toxicity tests with *Pimephales promelas* revealed no significant toxicity for fish in Grove Pond and Plow Shop Pond.

C. CBR comparison: The CBR comparison measurement endpoint was given a medium-high weight. The results for the CBR comparison in six fish species collected from Grove Pond indicated that three metals (copper, lead, and zinc) exceeded their LOAEL level by small margins (highest average HQ [hazard quotient]$_{LOAEL}$ = 2.9 for copper in bullhead). These results suggested the presence of low risk to fish in Grove Pond.

The results for the CBR comparison in four fish species collected from Plow Shop Pond, indicated that only copper exceeded its LOAEL level by a small margin (highest average HQ_{LOAEL} = 2.5 in bullhead). These results also suggested the presence of low risk to fish in Plow Shop Pond. Integrating these three lines of evidence, the fish community in either Grove Pond or Plow Shop Ponds is not likely to be at substantial risk from exposure to COPCs. The low risk identified by the CBR comparisons would not have community-level impacts because all the LOAEL exceedances were low, and both copper and zinc are under physiological control.

E.2.2.4 Omnivorous Mammals

The raccoon was the target receptor representing omnivorous mammals feeding at the Site. Only one LOE was available to assess risk to this receptor group. Food chain modeling was used to calculate COPC-specific total daily doses (TDD) for comparison to mammalian Toxicity Reference Values (TRVs). Most of the COPC concentrations in the food items used in modeling were based on site-specific measurements or estimates. Hence, this LOE was given a medium-to-high weight.

The results of the HQ calculations indicated it unlikely that omnivorous mammals would experience unacceptable risk from foraging in Grove Pond. However, the potential for high risk was identified for omnivorous mammals foraging in Plow Shop Pond, mainly because of the incidental ingestion of arsenic in pond sediments. There was significant uncertainty associated with this finding, as discussed below.

E.2.2.5 Piscivorous Mammals

The mink was the target receptor representing piscivorous mammals feeding at the Site. Only one LOE was available to assess risk to this receptor group. Food chain modeling was used to calculate COPC-specific TDDs for comparison to mammalian TRVs. Most of the COPC concentrations in the food items used in modeling were based on site-specific measurements or estimates. Hence, this LOE was given a medium-to-high weight.

The results of the HQ calculations indicate that it was not likely that piscivorous mammals would experience unacceptable risk from foraging in Grove Pond or Plow Shop Pond.

E.2.2.6 Carnivorous Birds

The black-crowned night heron was the target receptor representing carnivorous birds feeding at the Site. Only one LOE was available to assess risk to this receptor group. Food chain modeling was used to calculate COPC-specific TDDs for comparison to bird TRVs. Most of the COPC concentrations in the food items used in modeling were based on site-specific measurements or estimates. Hence, this LOE was given a medium-to-high weight.

The results of the HQ calculations indicated the potential for high risk to carnivorous birds foraging in both Grove Pond and Plow Shop Pond, mainly owing to the incidental ingestion of chromium in pond sediments. There was significant uncertainty associated with this finding, as discussed below.

E.2.2.7 Piscivorous Birds

The kingfisher was the target receptor representing piscivorous birds feeding at the Site. Only one LOE was available to assess risk to this receptor group. Food chain modeling was used to calculate COPC-specific TDDs for comparison to bird TRVs. Most of the COPC concentrations in the food items used in modeling were based on site-specific measurements or estimates. Hence, this LOE was given a medium-to-high weight.

The results of the HQ calculations indicated that it was not likely that piscivorous birds foraging in Grove Pond would experience unacceptable risk. However, the potential for medium risk was identified for piscivorous birds foraging in Plow Shop Pond, owing to excessive levels of methyl mercury in fish.

E.2.2.8 Insectivorous Birds

The tree swallow was the target receptor representing insectivorous birds feeding at the Site. Only one LOE was used to assess risk to this receptor group. Food chain modeling was used to calculate COPC-specific TDDs for comparison to bird TRVs. The COPC concentrations used in modeling were based on the analysis of tree swallow stomach contents. Hence, this LOE was given a medium-to-high weight.

The results of the HQ calculations indicated that insectivorous birds foraging in Grove Pond and Plow Shop Pond would likely experience medium risk, mainly because of the presence of high chromium levels in stomach contents.

E.2.3 MAJOR UNCERTAINTIES

The potential for high risk from sediment ingestion was identified for omnivorous mammals (represented by the raccoon) and carnivorous birds (represented by the black-crowned night heron) foraging in the two Site ponds. Several major uncertainties are associated with these risk estimates.

Firstly, unacceptable risk was identified for the raccoon in Plow Shop Pond because of incidental ingestion of arsenic in sediment. The sediment uptake assumption for the raccoon (9% of the diet) was taken from EPA (1993). Because the value was based on conditions different from those in the ponds, there is uncertainty in the accuracy of this value for Grove Pond and Plow Shop raccoons, or other omnivorous mammals. This uncertainty is particularly important because the unacceptable risk concluded for the raccoon in Plow Shop Pond is due to incidental ingestion of arsenic in sediment. Therefore, the risk assumption relies entirely on the sediment intake assumption for this species.

Similarly, the sediment uptake assumption for the black-crowned night heron (2% of the diet) was based on a best professional judgment. There were no measured values for similar species that could have been used with more confidence; EPA (1993) lists an uptake for other aquatic birds at 2%. This uncertainty is particularly important because the unacceptable risk concluded for the black-crowned night heron in both ponds is due to incidental ingestion of chromium in sediment. Therefore, the risk assumption relies entirely on the sediment intake assumption for this species. For both the raccoon and the night heron, uncertainty is associated with the sediment ingestion rates for another reason. The estimated sediment uptake percentages are potentially overestimated because of the dense vegetative mat that exists throughout the ponds.

Because this mat may act as a barrier between sediment and biota, wildlife receptors may have limited direct exposure to sediment substrate. The incidental ingestion assumptions (e.g., 0.09 for the raccoon and 0.02 for the black-crowned night heron potentially overestimate risk from this pathway.

SECTION 1.0: INTRODUCTION

The U.S. Environmental Protection Agency (USEPA) directed Gannett Fleming, Inc. (Gannett Fleming) to prepare this Baseline Ecological Risk Assessment (BERA) Report as part of the Grove and Plow Shop Ponds Expanded Site Investigation (ESI). This report is in response to the Task Order #01 to Contract EP-W-05-020, Remedial Oversight of Activities at Fort Devens Plow Shop and Grove Ponds. The objective of the BERA is to provide a quantitative estimate of risk posed to ecological receptors potentially exposed to Grove Pond and Plow Shop Pond media.

The BERA evaluated the potential risks to aquatic organisms (benthic invertebrates, water column invertebrates and fish) directly exposed to surface water and sediments in the ponds. The BERA also evaluated potential risk to omnivorous and piscivorous mammals and carnivorous, piscivorous, and insectivorous birds exposed to contaminants in surface water, sediments and aquatic biota in the ponds.

The BERA discussed in this report includes the following general elements:

- a brief overview of the site history and environmental setting,
- a summary of the analytical data for sediments, surface water and aquatic biota collected from Grove Pond and Plow Shop Pond, and
- a risk analysis to quantify the potential impacts of site-related contaminants on the long-term health of benthic invertebrates, water column invertebrates, fish, and wildlife.

The BERA was developed following the general guidelines provided in EPA (1997) and EPA (1998).

1.1 REPORT ORGANIZATION

The BERA report is organized as follows (review to see that this matches with the actual info in the sections):

- Section 2 provides a general description of Grove Pond and Plow Shop Pond, including site history, background information, and the ecological setting.

- Section 3 discusses the analytical database development and data processing. It includes discussions on data sources, data quality issues, and compilation of data sets for use in the BERA.

- Section 4 covers problem formulation. This section includes discussions on site characterization, selection of contaminants of potential concern (COPC), the conceptual site model, assessment and measurement endpoints, and the weight-of-evidence documentation.

- Section 5 presents the ecological exposure assessment. This section includes discussions on calculating and quantifying ecological exposures to the various receptor groups.

- Section 6 discusses the ecological effects assessment. This section covers discussions on selecting measures of effect and the methodologies used for deriving toxicity values used in the risk characterization.

- Section 7 presents the ecological risk characterization. This section includes a discussion on the risks to the eight assessment endpoints selected during problem formulation and a detailed uncertainty analysis.

- Section 8 provides a summary and conclusions.

- Section 9 provides the references used in support of the BERA.

SECTION 2: SITE DESCRIPTION

2.1 FORT DEVENS GROVE POND AND PLOW SHOP POND SITE PROFILE

Grove Pond and Plow Shop Pond are located in Ayer, Massachusetts, northeast of the former Fort Devens currently referred to as Devens. Devens was named to the National Priorities List (NPL) in November 1989. In October 1995, the Army issued a report that summarized all of the information collected to date and performed a Preliminary Risk Evaluation (PRE) in order to qualitatively gauge what risk the ponds were posing to human health and the environment. Primary concerns focused on the impacts from the ponds on Town and Devens drinking water supplies, fish and wildlife resources, and recreational activities such as fishing, hunting, and swimming. The PRE determined that exposure to both Plow Shop and Grove Pond sediments presented both human health and ecological risks.

Pursuant to a Memorandum of Understanding (MOU) signed in September 1997 for the landfill consolidation project, EPA Region I is the lead agency for conducting the remaining investigatory work and the selection and implementation of a remedial action for the ponds. In the late 1990s, EPA, in cooperation with the U.S. Fish and Wildlife, the U.S. Geological Service and the MADEP, embarked on an effort to collect the necessary information to address the data gaps identified in the Army's 1995 report. The data collected from the joint effort is to be used to compile an Expanded Site Investigation (ESI) for both Grove and Plow Shop Ponds. This BERA was written in support of the ESI.

Devens is not the only source of chemical inputs into the ponds. Besides regional atmospheric deposition and groundwater inputs, the ponds receive water from upstream source. Grove and Plow Shop Ponds are the most downstream in a series of six impoundments. In addition, several local features are potential sources of contaminants, including: a former tannery in Tannery Cove in Grove Pond, the Ayer Demolition Landfill adjacent to Tannery Cove, a plastics business on the northwest shore of Grove Pond, Shepley's Hill Landfill to the west of Plow Shop Pond, the Former Railroad Roundhouse on the southern shore of Plow Shop Pond, and a 19^{th} Century industrial facility on the north shore of Plow Shop Pond.

While the southern shore of Grove Pond is bordered by property owned by Fort Devens, the northern shore includes the location of the Plastic Distributing Company (PDC, location of former tannery operations). In addition, the western edge of the pond is formed by the railroad causeway, owned and operated by Guildford Transportation (formerly Boston & Maine Railroad, B&MRR). Grove Pond receives drainage from Balch Pond, as well as from Cold Spring Brook and Bowers Brook, and discharges through a culvert on the western edge of the pond into Plow Shop Pond. Cold Spring Brook is downgradient of Devens. Bowers Brook connects into Cold Spring Brook.

The northern shore of Plow Shop Pond is bordered by commercial businesses to the north. The eastern shore is the Guilford Transportation railroad causeway, which separates Plow Shop Pond from Grove Pond. The southern and western shores include the former railroad roundhouse, and woodland and grassland associated with Shepley's Hill Landfill. At one time, the pond discharged through a canal at a sawmill (now the G. V. Moore Lumber Co.) operating near the pond's northeast corner. This canal is blocked, and the water level is now controlled primarily by a dam in the pond's northwest corner where it forms Nonacoicus Brook and its associated wetlands, which in turn flows approximately 1.5 miles northwest into the Nashua River.

2.2 ECOLOGICAL SETTING

The evaluation of the ecological setting is prerequisite to identifying complete ecological exposure pathways, ecological assessment endpoints, representative ecological receptors, and exposure parameters. The ponds are mostly surrounded by a thin strip of riparian habitat, which could provide cover for the wildlife species evaluated in this BERA. While these receptors might forage in the upland areas as well as in the ponds, the focus of this BERA is the ponds only.

<u>Grove Pond</u>

Grove Pond is a shallow, 60-acre impoundment, the fifth in a chain of ponds in Ayer, MA. The maximum depth of Grove Pond is 5 to 6 feet. The pond has been described as eutrophic (Meirzykowski and Karr 2000). Grove Pond seasonally supports dense growths of rooted vascular aquatic plants and emergent marsh plants (ABB 1995) both of which cover most of its surface. The pond bottom consists of a thick layer of organic sediment and peat up to several feet thick (ABB 1995). Due to its high organic content and eutrophic nature, the pond water experiences seasonal oxygen deficiencies.

Various tree and shrub species fringe the edges of Grove Pond, including red maple (*Acer rubrum*), oak species (*Quercus* spp.), grey birch (*Betula populifolia*), white pine (*Pinus strobus*), sheep laurel (*Kalmia angustifolia*), and swamp azalea (*Rhododendrun viscosum*). Typical herbaceous components include various graminoids, cinnamon fern (*Osmunda cinnamomea*), and sphagnum moss (*Sphagnum* sp.) (ABB 1995).

Grove Pond provides habitat for many species of mammalian wildlife, including raccoon (*Procyon lotor*), mink (*Mustela vison*), muskrat (*Ondrata zibethicus*), and beaver (*Castor canadensis*) (ABB 1995). Species of birds that may be found in the area include belted kingfisher (*Ceryle alcyon*), black-crowned night heron (*Nycticorax nycticorax*), mallard (*Anas platyrhynchos*), wood duck (*Aix sponsa*), great blue heron (*Ardea herodias*), and osprey (*Pandion haliaetus*) (ABB 1995). Green frogs (*Rana clamitans*) and painted turtles (*Chrysemys picta*) have been observed in Grove Pond and it is likely that other reptile and amphibian species inhabit the area (ABB 1995). Fish species observed in the pond include largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), bullhead (*Ameiurus* sp.), and chain pickerel (*Esox Niger*) (ABB 1995).

According to the Fort Devens Basewide Biological and Endangered Species Survey (ABB-ES 1993), no state or federally listed rare or endangered species occur in Grove Pond or its floodplain (as cited in ABB 1995).

Plow Shop Pond

Plow Shop Pond is a shallow 29-acre impoundment located just west and downstream of Grove Pond. As an aquatic community, Plow Shop Pond is similar to Grove Pond but is smaller, slightly deeper (maximum depth of 8-10 feet), and has a less dense growth of aquatic vegetation, though seasonally, more than 80% of the pond surface is covered with aquatic macrophytes. The bottom of Plow Shop Pond also consists of a layer of highly organic sediment and peat up to several feet thick.

Plow Shop Pond is eutrophic and has been classified as a floating-leaved deep marsh (E&E 1993 [as cited in ABB 1995]). Emergent aquatic macrophytes in the pond include sweet water lily (*Nymphaea odorata*) and water shield *(Brasenia schreberi*). Submerged macrophytes, primarily marigold (*Megalodonta beckii*), seasonally cover more than 75% of the submerged portions of the pond. The pond bottom consists primarily of highly organic sediments and peat ranging in depth from approximately 1 foot to over 7 feet. Wildlife species using Plow Shop Pond are the same as those using Grove Pond. Fish species in Plow Shop Pond are also similar to those in Grove Pond; in fact, fish can pass freely between the ponds.

SECTION 3: DATABASE DEVELOPMENT AND DATA PROCESSING

3.1 INTRODUCTION

Continuing concerns for potential impacts, from military activities and from local industrial operations, on adjacent bodies of water (e.g. Grove Pond, Plow Shop Pond, and Nonacoicus Brook) and on groundwater in the overburden aquifer in the vicinity have motivated a number of studies on the ponds. Data from these many studies were consolidated and a large data set was established from these various sources.

Because these investigations focused on different areas, different media, and different contaminants, a data gap evaluation (Gannett Fleming 2002) was conducted to determine which pieces of information were missing for a more comprehensive evaluation of risk in the ponds. The Data Gap Evaluation identified the need for additional surface water and sediment sampling, sediment and surface water toxicity tests, and fish tissue sampling in both ponds. EPA Region 1 conducted these activities in 2004 and 2005..

EPA conducted this additional surface water, sediment, and fish sampling in 2004 and 2005 in Grove Pond, Plow Shop Pond, and a reference location, Flannagan Pond. Flannagan Pond is an 87-acre impoundment with similar characteristics as the other two ponds.

The locations of most recent sediment samples for chemical analysis and sediment toxicity tests are the following:

> Grove Pond: one sample near Tannery Cove because of the high concentrations detected there historically; one sample off the western shore, near Army property, one sample near the middle of the pond.
>
> Plow Shop Pond: two samples within Red Cove because of the historically high concentrations, particularly of arsenic, in this area; two samples along the western shoreline of the pond to capture possible contamination from groundwater discharge from Shepley's Landfill; two samples extending in a transect from Red Cove towards the middle of the pond to capture possible gradients from Red Cove; two samples near the southern shoreline; two samples near the Railroad Roundhouse; and one sample near the inflow from Grove Pond.

3.2 DATA SOURCES

The specific data sources used in support of the current BERA can be summarized as follows:

3.2.1 Grove Pond

Surface water

A total of 20 surface water samples were collected and analyzed for dissolved metals. These samples were collected as part of different investigations from 1993 to 2004.

A total of 31 surface water samples were collected and analyzed for total metals. These samples were collected as part of different investigations from 1992 to 2005.

Sediment

A total of 147 sediment samples were collected and analyzed for metals; 87 samples were also analyzed for pesticides and PCBs; 72 samples were analyzed for PAHs; and 21 were analyzed for VOCs. These samples were collected as part of different investigations from 1992 to 2005.

Aquatic Biota

A total of 97 biological tissue samples were collected from Grove Pond. Thirty- two fish samples were collected in 1992 and 2004 and analyzed for metals, pesticides, and PCBs. Six crayfish samples were collected in 1998 and 2000 and analyzed for metals. The three crayfish samples from 2000 were actually composite samples and the exact number of crayfish collected was not reported. Four composite odonata samples were collected in 2001 and analyzed for metals. Twenty-five frog tissue samples were collected in 1999 and analyzed for metals. Twenty tree swallow egg samples were collected in 1998 and 1999 and analyzed for metals. Finally, 10 samples of tree swallow stomach contents (boli) were collected in 1999 and analyzed for metals.

3.2.2 Plow Shop Pond

Surface Water

A total of 10 surface water samples were collected and analyzed for dissolved metals. These samples were collected in 2004.

A total of 30 surface water samples were collected and analyzed for total metals. These samples were collected as part of different investigations from 1991 to 2004.

Sediment

A total of 126 sediment samples were collected and analyzed for metals; 56 samples were also analyzed for pesticides and PCBs; 28 samples were analyzed for PAHs; and 13 were analyzed for VOCs. These samples were collected as part of different investigations from 1991 to 2005.

Aquatic Biota

A total of 62 biological tissue samples were collected from Plow Shop Pond. Nineteen fish samples were collected in 1992 and 2004 and analyzed for metals, pesticides, and PCBs. Six mussel samples were collected in 1998 and analyzed for metals. Five crayfish samples were collected in 1998 and 2000 and analyzed for metals. The four crayfish samples from 2000 were actually composite samples and the exact number of crayfish collected was not reported. Four composite odonata samples were collected in 2000 and analyzed for metals. Thirteen frog tissue samples were collected in 1999 and analyzed for metals. Thirteen swallow egg samples were collected in 1998 and 1999 and analyzed for metals. Finally, three samples of tree swallow stomach contents (boli) were collected in 1999 and analyzed for metals.

3.3 DATA QUALITY

The analytical data used for this risk assessment were taken from various studies and were not collected for risk assessment purposes in all cases. This subsection describes how the data from all of the various Grove Pond and Plow Shop Pond investigations were selected for use in the BERA.

3.3.1 Data Sorting

Data compiled together from various sources were sorted by environmental medium. The specific media evaluated in the BERA were identified in section 3.2 and included surface water, sediments, and aquatic biota collected from Grove Pond and Plow Shop Pond.

Sediment samples were divided into surficial sediments (0-1 ft deep) and deeper sediments (>1 ft deep). Only the analytical data from surficial sediments were retained because most biological activity occurs within this oxygenated upper layer. In addition, wildlife receptors would be unlikely to come in contact with deep sediments during normal foraging activities.

Surface water samples collected from the two ponds were divided into unfiltered and filtered samples for metals analysis. The unfiltered samples provided data on total metals, that included the dissolved fraction together with the fraction associated with particulate matter. By definition, the filtered samples provided data only on dissolved metals, which have been shown to represent the fraction most toxic to aquatic receptors. Data on both total and dissolved metals were included in the database and used in the BERA. For benchmark screening, only the filtered metal concentrations were compared to surface water ecological benchmarks. For food chain modeling, however, unfiltered metal concentrations were used to better reflect total metal uptake by wildlife receptors drinking surface water from the two ponds.

3.3.2 Evaluation of Data Usability

The results of the chemical analyses of the surface water samples collected from Grove Pond and Plow Shop Pond are provided in Appendices A and B, respectively. The majority of the reports used to establish the database for the present risk assessment did not include laboratory analytical reports. Where analytical reports were not available, summary tables found within the documents were used.

Gannett Fleming, Inc. (GF) conducted a data validation review as part of the Data Gap Evaluation. The purpose of the review was to evaluate the general quality of each data set and determine the usability of the data for the ESI Report. The data were reviewed to evaluate: 1) The level of data validation or review performed at the time the data were generated, 2) the analytical protocols and laboratories used, and 3) the availability of Quality Assurance/Quality Control information. A comprehensive discussion of this review is provided in Section 3.0 of the ESI Report.

Data were determined to be usable for the ESI Report under the following conditions: 1) EPA-approved or equivalent laboratory methods were used, 2) data were generated by an EPA laboratory or under the Army Corps of Engineers analytical review protocols, 3) enough QA/QC information was provided in the report to perform a Tier II level data validation at a future time, or 4) EPA had already reviewed and accepted the data. If none of these conditions were met, the data set was assigned a "Not Acceptable" data usability code and was not used in the ESI Report.

3.3.3 Comparison to Background

In accordance with accepted EPA Region I ecological risk assessment practices, background concentrations were not incorporated into the COPC selection process. Rather, background concentrations were considered as part of the Risk Characterization to identify COPCs that may be influenced by regional or upstream inputs. Residual risks (RRs) were estimated by dividing the risk for analytes measured in the ponds by the risk from these same analytes measured in background samples. This evaluation is presented within the Risk Characterization of the BERA. In addition, a comparison of Grove Pond and Plow Shop Pond data to the background data set is discussed in the Nature and Extent Section of the ESI Report.

The derivation of background HQs for the residual risk evaluation is presented in Appendix G. Surface water, sediment, and fish data from the 2004 and 2005 collection effort in Flannagan Pond (Appendix C) were used to establish background EPCs. There are no background data for invertebrate tissue, frog tissue, swallow eggs, or swallow stomach contents. Background EPCs for non-fish biota were estimated from background sediment concentrations and BSAFs. In order to not overestimate background concentrations in biota and to parallel the approach used for the two ponds, BSAFs were derived from Grove Pond and Plow Shop Pond sediment and biota data Appendix Tables G-1 through G-4). Four BSAF were derived, one based on maximum EPC for sediment and biota for each pond and one based on average EPCs. This provided a range of BSAFs. The BSAF selected for the background food chain model was the BSAF derived for the sediment concentration closest to the sediment concentration in Flannagan Pond.

Residual risk was calculated by dividing the Grove Pond/Plow Shop Pond HQ by the background HQ.

Risk in Grove Pond and Plow Shop Pond was determined to be due to background conditions if that risk was less than that measured in background (i.e., if RR < 1.0). If the RR was above 1.0, then the site risk exceeded the background risk and the residual risk may have been due to pond-specific contamination.

3.4 COMPILING DATA SETS FOR USE IN THE BERA

The final product of the data evaluation and summarization process is a comprehensive database for use in quantitative risk assessment. Data sets for each pond were developed by compiling analytical results for each medium of interest (i.e., surface water, sediment, aquatic biota) and analyte group (i.e., metals, organics).

3.4.1 Data Summarization Methods

Each data set was summarized to provide the following descriptors:

- maximum detected concentration,
- average detected concentration, and
- frequency of detection (= number of detected values over the number of samples analyzed).

The following procedures were applied to compile data for a particular analyte in a given medium for calculating the summary statistics used in the BERA:

- Results assigned qualifiers indicating that an analyte was positively detected or presumptively present were retained for use "as is" in the risk calculations.
- Results assigned qualifiers indicating that an analyte was not positively detected were retained at one half their detection limit for use in the risk calculations if that analyte was detected in at least one of the samples. An analyte was dropped from further

consideration and not used in the calculations if it was present below its detection limit in all of the samples

- Any results considered of inadequate quality (i.e., data qualified as rejected) were not used in the risk calculations.

- Analytical results for samples collected from the same locations but during different sampling events were considered unique samples and were not averaged together.

3.4.2 Summary Statistics

For all media, an arithmetic mean concentration was calculated for each analyte retained in the database. For samples with a concentration of a particular chemical below the detection limit, ½ the detection limit was used in the calculation of the average concentration.

The maximum concentration value instead of the 95% upper confidence limit (UCL) was used in the risk calculations for each analyte retained in the database. These values were not intended to calculate realistic exposures. Instead, the maximum concentrations were used to provide a worst-case risk ceiling. The actual assessment of risk relied on the mean concentrations.

Appendix A provides the summarized analytical data for surface water, sediment, and biological tissue collected in Grove Pond. Appendix B provides the summarized analytical data for Plow Shop Pond. Appendix C provides the summarized analytical data for the reference condition. Note that Section 4 discusses the process for selecting the contaminant of potential concern (COPCs) identified in these attachments.

3.4.3 Data Sets Used in the BERA

The sources of data used in the BERA are summarized in Table 1 (Grove Pond) and Table 2 (Plow Shop Pond). The data for surface water, sediment, and biological tissues are summarized in Appendices A, B, and C.

SECTION 4: PROBLEM FORMULATION

4.1 INTRODUCTION

The problem formulation for the BERA focuses on developing a conceptual site model (CSM) and identifying appropriate criteria and toxicological benchmarks to select COPCs from the available analytical data. The CSM identifies the presence of complete exposure pathways between site-related contaminant sources and ecological receptors. It also relates assessment and measurement endpoints to characterize ecological exposure (Section 5.0), effects (Section 6.0) and risk characterization (Section 7.0) for Grove Pond and Plow Shop Pond.

This chapter is organized as follows: Section 4.2 summarizes the site characterization and defines the exposure units (EU), Section 4.3 describes the selection process to identify the COPCs used in the risk calculations, Section 4.4 provides the CSM, and Section 4.5 outlines the assessment and measurement endpoints.

4.2 SITE CHARACTERIZATION

The evaluation of the ecological setting is prerequisite to identifying complete ecological exposure pathways, ecological assessment endpoints, representative ecological receptors, and exposure parameters.

4.2.1 Site Exposure Units

Two exposure units are covered in this BERA, Grove Pond and Plow Shop Pond. The locations and ecological setting of each pond is described in Section 2.0. The exposure units are limited by the shoreline; while some ecological receptors forage in upland areas as well as within the ponds, this BERA only focuses on exposure to COPC within pond media.

Throughout both ponds, the aquatic system provides suitable habitat for water column invertebrates, several species of fish, various taxa of benthic invertebrates, reptiles, amphibians, birds, and mammals. The assessment of habitat and identification of organisms likely to forage within these habitats were used to identify representative ecological receptors for the Assessment and Measurement endpoints discussed in Section 4.5.

4.2.2 Background Exposure Unit

The background EU for Grove Pond and Plow Shop Pond is regional aquatic habitats not affected by the local sources of contamination that have released chemicals to the ponds, as discussed in Section 2.0 of the ESI Report. Flannagan Pond was selected as a reference location for targeted sampling in 2004 and 2005 to represent background conditions for the ponds.

4.3 SELECTING CONTAMINANTS OF POTENTIAL CONCERN (COPCs)

COPCs represent a subset of the analytes detected in site media that could potentially affect local ecological receptors. The COPC selection process consisted of comparing maximum analyte concentrations detected in surface water and sediments against conservative published surface water and sediment screening benchmarks. An analyte detected in surface water or sediment was retained as a COPC if its maximum detected concentration exceeded its benchmark.

The essential nutrients calcium, iron, magnesium, potassium and sodium were automatically eliminated as potential COPCs as they are only considered toxic at extremely high concentrations. An analyte detected in surface water or sediment was also retained as a COPC if it did not have a corresponding screening value. All analytes detected in biological tissue samples in Grove Pond and Plow Shop Pond were retained as COPCs.

A basic assumption was made about using sediment benchmarks in selecting COPCs for wildlife receptors that may forage in Grove Pond and Plow Shop Pond. These conservative benchmarks represent concentrations that would not harm benthic organisms chronically exposed to the contaminants. It was assumed that if those concentrations did not harm benthic invertebrates exposed over long periods of time, then it would also not harm wildlife receptors exposed to small amounts via incidental ingestion.

4.3.1 Surface Water Benchmarks

Surface water COPCs were selected for each Site Pond by comparing the maximum detected surface water concentrations to chronic surface water benchmarks obtained from the literature in the following order of preference:

- EPA National Ambient Water Quality Criteria (NAWQC) - Criterion Continuous Concentration (CCC) for chronic exposures (EPA 2002). The EPA NAWQC represent concentrations in surface water which, if not exceeded for four consecutive days over a three-year period, are not expected to cause unacceptable harm to aquatic organisms.

- Tier II Secondary Chronic Values (SCV) (Suter and Tsao 1996). The SCVs were developed by the Oak Ridge National Laboratory (ORNL) using a method similar to that used for the NAWQC, except that they are based on a less-complete data set than required for calculating NAWQC.

The ecological benchmarks for surface water are provided in Table 3 (Grove Pond) and Table 4 (Plow Shop Pond). Except as noted in Table 3 and Table 4, comparisons were made between dissolved concentrations of metals and surface water benchmarks, as surface water benchmarks are generally available for dissolved, not total, concentrations. Therefore, while total surface water concentrations are presented elsewhere, e.g., in the food chain model EPC table and in the data tables for the toxicity tests, these data for total metals were not used to select COPC.

4.3.2 Sediment Benchmarks

Sediment COPCs were selected for each Site Pond by comparing the maximum detected sediment concentrations to conservative no effect sediment benchmarks obtained from the literature in the following order of preference:

- EPA Sediment Quality Benchmarks (SQB) (EPA 1996). The EPA developed these benchmarks for use as screening tools within the Superfund program. They were obtained from diverse sources, some of which are described below.

- MacDonald *et al*. (2000) Threshold Effects Concentrations (TEC). TECs represent values below which harmful effects to benthic invertebrates are unlikely to be observed.

- Ontario Ministry of the Environment Low-Effects Level (LEL) (Persaud *et al*. 1993). LELs represent values below which no effects are expected for the majority of sediment dwelling organisms.

- National Oceanic and Atmospheric Administration (NOAA) Effects Range-Low (ER-L)(Long *et al*. 1995). ER-Ls are concentrations measured in estuarine or marine environments below which toxicity to benthic invertebrates rarely occurred.

The EPC and ecological benchmarks for sediments are provided in Table 5 (Grove Pond) and Table 6 (Plow Shop Pond).

4.3.3 Media-Specific COPCs

Ecological COPCs are the analytes detected in site media with concentrations that exceed available conservative benchmarks. Table 3 and Table 4 present the benchmark screening used to select surface water COPCs for Grove Pond and Plow Shop Pond, respectively. Table 5 and Table 6 present the benchmark screening used to select sediment COPCs for Grove Pond and Plow Shop Pond, respectively.

4.3.3.1 Surface Water COPCs

Grove Pond

Three inorganics (aluminum, barium, and manganese) were detected at concentrations that exceeded chronic benchmarks for surface water and were retained as surface water COPC in Grove Pond.

Plow Shop Pond

Four inorganics (aluminum, barium, manganese, and selenium) were detected at concentrations that exceeded chronic benchmarks for surface water and were retained as surface water COPC in Plow Shop Pond.

4.3.3.2 Sediment COPCs

Grove Pond

Nineteen metals (all metals other than essential nutrients), four pesticides, and 18 SVOC (including total PAHs) were selected as sediment COPC in Grove Pond.

Plow Shop Pond

Nineteen metals (all metals other than essential nutrients), two pesticides, two PCBs, 17 SVOC (including total PAHs), one VOC (acetone) were selected as sediment COPC in Plow Shop Pond.

4.3.3.3 Biota COPCs

All chemicals present in biological samples above their analytical detection limit, except for the essential nutrients, were retained as COPCs. Most chemicals detected in biological samples were already identified as sediment COPCs. However, several more were included as biological tissue COPCs:

Grove Pond

One inorganic chemical, strontium, was added as a COPC due to detected concentrations in fish, invertebrate, and frog tissue. Total PCBs was added as a COPC in due to detected concentrations in fish tissue.

Plow Shop Pond

Two inorganic chemicals were added as a COPC in Plow Shop Pond: boron, due to detected concentrations in invertebrate tissue, and strontium, due to detected concentrations in invertebrate and frog tissue.

4.4 CONCEPTUAL SITE MODEL (CSM)

A CSM identifies the sources, media, pathways and exposures evaluated in the BERA, and the relationship between the assessment and measurement endpoints. Its purpose is to illustrate how ecological receptors might come in contact with COPCs associated with releases from the site. The CSM for ecological exposures for Grove Pond and Plow Shop Pond is presented in Figure 1.

The source of chemical stressors to pond receptors is the reservoir of chemical constituents concentrated in surficial sediments, from known and unknown sources in the watershed. Contaminants in sediments can be taken-up via direct contact by benthic organisms. Contaminants in sediments can also be ingested by terrestrial wildlife foraging in shallow parts of the pond. Sediment COPCs that go into solution in the overlying water can be absorbed by water column biota and can also be ingested by wildlife foraging in the pond. Finally, sediment COPCs can also migrate into the aquatic food web, via bioaccumulation in aquatic invertebrates, and become available to foraging aquatic biota as well as terrestrial wildlife.

A CSM for hydrology and geochemistry that describes in more detail the migration pathways from chemical sources to pond sediments and surface water is discussed in the Nature and Extent section of the ESI Report.

4.4.1 Exposure Pathways

Ecological receptors and exposure pathways were evaluated in accordance with the *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessment* (EPA 1997). Receptor populations that were reasonably anticipated to be exposed to chemicals of concern on the site were identified.

For an exposure pathway to be complete, an ecological receptor must be able to access the media containing site contaminants. Contaminants must also be bioavailable to the receptor through one or more exposure routes. Exposure pathways are generally considered complete when all of the following are present: a chemical that exhibits toxicity, an exposure point, an exposure route, and an ecological receptor. An exposure point is a location of potential contact between an organism and a chemical. The exposure route is the way a chemical comes in contact with an organism (e.g., by ingestion). Ecological receptors can be exposed to chemicals in various media, including: surface water, sediment, surface soil, plants, and aquatic and terrestrial prey species. This BERA incorporates potential exposure to surface water, sediment, plant, and aquatic prey species.

Ecological receptors at Grove Pond and Plow Shop Pond that may be exposed to contaminants in pond media include aquatic biota (e.g., benthic macroinvertebrates, pelagic macroinvertebrates, and fish) as well as terrestrial/semi-aquatic birds and mammals that feed on pond biota.

4.4.1.1 Aquatic Exposure Pathways

Aquatic biota may be exposed directly to contaminants in surface water, sediments, and pore water. They can also be exposed via ingestion of surface water, sediments, pore water and organisms that have accumulated body burdens of chemicals.

- Organisms exposed primarily to contaminants via direct contact with surface water include planktonic species (e.g., zooplankton) or planktonic and older life stages of larger species (e.g., fish) swimming in the water column.

- Organisms exposed primarily to contaminants via direct contact with sediments or pore water include benthic invertebrates that spend their whole life in and on sediments (e.g., oligochaetes, amphipods, mussels) or juvenile life stages of terrestrial insects (e.g., stone flies, chironomids, mayflies, dragonflies). The amount of exposure experienced by a sediment dweller depends on several factors, including substrate composition (mud, sand, gravel), physical-chemical characteristics (e.g., organic carbon content, dissolved oxygen content, contaminant concentration, flow) and biological requirements (feeding requirements, burrowing vs. surface activities, water velocity requirements).

- Organisms exposed primarily to contaminants via food ingestion may include larger benthic invertebrates such as crayfish, and older life stages of fish.

4.4.1.2 Semi-Aquatic Exposure Pathways

The potential exposure pathways for terrestrial wildlife species associated with aquatic environments in Grove Pond and Plow Shop Pond are ingestion of pond biota and surface water, and sediment via incidental ingestion. Dermal absorption and inhalation were not evaluated in the BERA, as they are not thought to be significant sources of chemical exposure for the ecological receptors evaluated.

4.5 ASSESSMENT AND MEASUREMENT ENDPOINTS

Endpoints were selected to quantify potential risk to ecological receptors that may be exposed to chemicals in Grove Pond and Plow Shop Media. Assessment endpoints are expressions of the actual ecological value to be protected. The basic criteria for selecting assessment endpoints for this BERA include:

- the ecological resource should have relevance,
- the ecological resource should be susceptible to the stressors of concern,
- the ecological resource should have biological, social, and/or economic value, and
- the ecological resource should be relevant to the risk management goals for the site

Measurement endpoints are the aspects of the ecosystem that are measured to determine if the assessment endpoints are met. For this BERA, assessment and measurement endpoints were selected for aquatic communities and terrestrial wildlife. Assessment and measurement endpoints are presented in Table 7.

4.5.1 Selecting Representative Assessment Endpoint Species or Communities

Because it is not possible to evaluate all parts of the pond ecosystems potentially affected by contamination, this BERA focused on key ecological groups most likely exposed to site-related contaminants.

Amphibians and reptiles have been observed in both ponds. However, these receptors were not included in the evaluation because little or no toxicological data exist for use in risk assessment. It was assumed that the embryos and larvae of amphibians would represent the most sensitive life stage to aquatic exposures if the overall sensitivity of those aquatic life stages is assumed to be comparable to that of fish, then the assessment of risk to the latter receptor group would also represent amphibians. For reptiles (e.g., aquatic turtles), the potential for site-related risks was assumed to be no worse than that experienced by fish-eating birds.

4.5.1.1 Macroinvertebrate Communities

Macroinvertebrates are a basic component of all ecological systems. As well as acting as a major food source for higher trophic level organisms, macroinvertebrates play an important role in nutrient recycling and transfer to higher trophic levels. Significant alterations in macroinvertebrate communities could impact the energy cycling at the base of the aquatic food chain.

4.5.1.1.1 Water Column Invertebrates

The other assessment endpoint for aquatic invertebrates is the protection of the long-term health of water column invertebrate populations from sublethal and lethal toxic effects of chemicals in surface waters. Similar to the benthic invertebrates, water column invertebrates (e.g., zooplankton) play a role in the transfer of nutrients from primary consumers to upper trophic level organisms. They are also an important food source for many aquatic taxa including many species of fish. Chemicals in pond surface water could impair the water column invertebrate communities in the ponds, particularly by harming or eliminating sensitive species.

4.5.1.1.2 Benthic Invertebrates

For benthic invertebrates, the assessment endpoint is the protection of benthic macroinvertebrate communities from sublethal and lethal acute toxic effects of chemicals in sediments. The benthic community provides much important function in aquatic systems. Benthic organisms are a major component of many aquatic organisms, including many species and life stages of fish. Benthic organisms also play a role in the transfer of nutrients from the base of the food chain to higher trophic levels. As well as providing a mechanism for nutrients to reach higher trophic level organisms, benthic invertebrates transfer bioaccumulative chemicals in sediments to higher trophic levels.

Grove Pond and Plow Shop Pond sediments support a wide variety of invertebrate taxa. Chemicals in pond sediments could impair the invertebrate communities in the ponds, particularly by harming or eliminating sensitive species. A less diverse community, dominated by less sensitive species, and /or a less abundant community may result over time. Such a community is less equipped to provide the ecological functions of nutrient transfer and supplying food to upper trophic levels, thereby affecting the aquatic community as a whole.

4.5.1.2 Fish Receptors

The assessment endpoint for fish is the protection of the long-term health of local fish populations from sublethal and lethal toxic effects of chemicals in surface waters. Grove Pond and Plow Shop Pond support a warm water fish community, which includes brown bullhead, yellow bullhead, bluegill, pickerel, and largemouth bass. A healthy aquatic environment should provide such a community with a diverse food base, feeding and spawning areas, refuges for juvenile fish, and other essential environmental services.

The presence of chemicals in Grove Pond and Plow Shop Pond media could impair the local fish community directly in two general ways: 1) mortality of sensitive early lifestages exposed to chemicals dissolved in the water column, or 2) elevated levels of chemicals in the tissues of aquatic biota via food chain uptake which could affect reproduction and the long-term survival of exposed populations.

4.5.1.3 Wildlife Receptors

Several species of birds and mammals have been observed or have the potential to reside near and forage in Grove Pond and Plow Shop Pond. Omnivorous and piscivorous mammals and carnivorous, piscivorous, and insectivorous birds were evaluated in this BERA. These groups were selected because they area the most likely to experience the highest exposure to site COPC of all wildlife groups.

4.5.1.3.1 Omnivorous Mammals

One mammalian assessment endpoint is the protection of omnivorous mammals foraging in pond shallows, to insure that ingestion of chemicals in food items, sediment, and surface water does not have a negative impact on growth, survival, and reproduction. For omnivorous mammals, the ecological exposure routes of greatest significance are ingestion of fish and other aquatic biota, bird eggs, and water, and inadvertent ingestion of sediment. The raccoon (*Procyon lotor*) was selected as the representative omnivorous mammal species because its foraging habits would bring it into contact with contaminated media and food items and because it is likely to inhabit the site. It was also selected because of its high ingestion of sediment (9 percent of diet).

4.5.1.3.2 Piscivorous Mammals

The other assessment endpoint is the protection of piscivorous mammals foraging in the pond, to insure that ingestion of chemicals in food items, sediment, and surface water does not have a negative impact on growth, survival, and reproduction. For piscivorous mammals foraging in the ponds, the ecological exposure routes of greatest significance are ingestion of fish and water, and inadvertent ingestion of sediment. The mink *(Mustela vison*) was selected as the representative piscivorous mammal species because its foraging habits would bring it into contact with contaminated media and food items and because it is likely to inhabit the site.

4.5.1.3.3 Carnivorous Birds

One assessment endpoint for birds is the protection of carnivorous birds foraging in pond shallows, to insure that ingestion of chemicals in food items, sediment, and surface water does not have a negative impact on growth, survival, and reproduction. For carnivorous birds foraging in the ponds, the ecological exposure routes of greatest significance are ingestion of fish, other aquatic biota, and water, and inadvertent ingestion of sediment. The black-crowned night heron (*Nycticorax nycticorax)* was selected as the representative avian carnivorous species because its foraging habits would bring it into contact with contaminated media and food items and because it is likely to inhabit the site.

4.5.1.3.4 Piscivorous Birds

A second assessment endpoint for birds is the protection of piscivorous birds foraging in the pond, to insure that ingestion of chemicals in food items and surface water does not have a negative impact on growth, survival, and reproduction. For piscivorous birds foraging in the ponds, the ecological exposure routes of greatest significance are ingestion of fish and water. The belted kingfisher (Ceryle alcyon) was selected as the representative piscivorous bird species because its foraging habits would bring it into contact with contaminated media and food items and because it is likely to inhabit the site.

4.5.1.3.5 Insectivorous Birds

The last assessment endpoint is protection of insectivorous birds to insure that ingestion of chemicals in food items does not have a negative impact on growth, survival, and reproduction. For insectivorous birds, the ecological exposure route of greatest significance is the ingestion of aquatic insects emerging from the ponds. Because data from tree swallow (*Tachycineta bicolor*) stomach contents are available, this species was selected as the representative species for insectivorous birds.

4.5.2 Measurement Endpoints

Measurement endpoints were used to quantify the presence of potential risk to their associated assessment endpoints. The following measurement endpoints were selected for each of the assessment endpoints and their associated risk question.

4.5.2.1 Water Column Invertebrate Community

Protection of the long-term health of water column invertebrate populations from sublethal and lethal toxic effects of chemicals in surface waters. *Are the levels of contaminants in surface water sufficiently high to cause biologically significant changes or impair the function of the water column invertebrate community in Grove Pond and Plow Shop Pond?*

There are two measurement endpoints for this assessment endpoint:

1. Comparison of maximum and average site surface water concentrations to acute and chronic generic surface water benchmarks.

2. Surface water chronic toxicity test using the freshwater cladoceran (*Ceriodaphnia dubia*).

4.5.2.2 Benthic Macroinvertebrate Community

Protection of benthic macroinvertebrate communities from sublethal and lethal acute toxic effects of chemicals in sediments. *Are the levels of contaminants in sediments sufficiently high* *to cause biologically significant changes or impair the function of the benthic community in grove Pond or Plow Shop Pond?*

There are three measurement endpoints for this assessment endpoint:

1. Comparison of maximum and average site sediment concentrations to no effect and effect generic sediment benchmarks.

2. Sediment toxicity testing using a midge (*Hyallela azteca*) and amphipod (*Chironomus tentans*)

3. Comparison of maximum and average aquatic invertebrate tissue residue levels against target receptor critical body residues (CBRs)."

The bioavailability of metals was also assessed with acid volatile sulfide (AVS) and simultaneously extracted metal (SEM) data. The AVS/SEM evaluation is not considered a measurement endpoint in a strict sense, however, as it does not provide an actual measurement or estimation of effects. It is, rather, a tool that is used to modify certain aspects of Measurement Endpoints 1 and 2, the assessment of risk posed by inorganic COPC.

4.5.2.3 Fish Receptors

Protection of the long-term health of local fish populations from sublethal and lethal toxic effects of chemicals in surface waters. *Are the levels of contaminants within Grove Pond and Plow Shop Pond sufficiently high to cause biologically significant changes or impair the function of the warm water fish community?*

There are three measurement endpoints for this assessment endpoint:

1. Comparison of site surface water concentrations, or EPC, to the same surface water benchmarks as those used for water column invertebrates.

2. Surface water chronic toxicity test using the fathead minnow (*Pimephales promelas*).

3. Comparison of measured fish tissue residue levels against fish Critical Body Residues (CBR).

4.5.2.4 Omnivorous Mammals

Protection of omnivorous mammals foraging in pond shallows, to insure that ingestion of chemicals in food items, sediment, and surface water does not have a negative impact on growth, survival, and reproduction. *Are the levels of contaminants in surface water and aquatic prey sufficiently high to impair omnivorous mammal populations foraging in Grove Pond and Plow Shop Pond?*

The measurement endpoint is the calculation of a hazard quotient (HQ), which is the ratio of the estimated food web uptake of a given chemical to the literature toxicity reference value (TRV). The TRVs used are No Observed Adverse Effects Level (NOAEL)-based benchmarks from Sample *et al*. (1996). For chemicals for which the HQ exceeded 1, this assessment endpoint was not met, and potential deleterious effects on growth, survival, and reproduction in omnivorous mammals foraging in the pond was assumed.

4.5.2.5 Piscivorous Mammals

Protection of piscivorous mammals foraging in the pond, to insure that ingestion of chemicals in food items, sediment, and surface water does not have a negative impact on growth, survival, and reproduction. *Are the levels of contaminants in surface water and aquatic prey sufficiently high to impair piscivorous mammal populations foraging in Grove Pond and Plow Shop Pond?*

The measurement endpoint is the calculation of a hazard quotient (HQ), which is the ratio of the estimated food web uptake of a given chemical to the literature toxicity reference value (TRV). The TRVs used are No Observed Adverse Effects Level (NOAEL)-based benchmarks from Sample *et al*. (1996). For chemicals for which the HQ exceeded 1, this assessment endpoint was not met, and potential deleterious effects on growth, survival, and reproduction in piscivorous mammals foraging in the pond was assumed.

4.5.2.6 Carnivorous Birds

Protection of carnivorous birds foraging in pond shallows, to insure that ingestion of chemicals in food items, sediment, and surface water does not have a negative impact on growth, survival, and reproduction. *Are the levels of contaminants in surface water and aquatic prey sufficiently high to impair carnivorous bird populations foraging in Grove Pond and Plow Shop Pond?*

The measurement endpoint is the calculation of an HQ, which is the ratio of the estimated food web uptake of a given chemical to the literature TRV. The TRVs used are NOAEL-based benchmarks from Sample *et al*. (1996). For chemicals for which the HQ exceeded 1, this assessment endpoint was not met, and potential deleterious effects on growth, survival, and reproduction in carnivorous birds foraging in the pond was assumed.

4.5.2.7 Piscivorous Birds

Protection of piscivorous birds foraging in the pond, to insure that ingestion of chemicals in food items and surface water does not have a negative impact on growth, survival, and reproduction. *Are the levels of contaminants in surface water and aquatic prey sufficiently high to impair piscivorous bird populations foraging in Grove Pond and Plow Shop Pond?*

The measurement endpoint is the calculation of an HQ, which is the ratio of the estimated food web uptake of a given chemical to the literature TRV. The TRVs used are NOAEL-based benchmarks from Sample *et al*. (1996). For chemicals for which the HQ exceeded 1, this assessment endpoint was not met, and potential deleterious effects on growth, survival, and reproduction in piscivorous birds foraging in the pond was assumed.

4.5.2.8 Insectivorous Birds

Protection of insectivorous birds to insure that ingestion of chemicals in food items does not have a negative impact on growth, survival, and reproduction. *Are the levels of contaminants in surface water and aquatic prey sufficiently high to impair insectivorous bird populations foraging in Grove Pond and Plow Shop Pond?*

The measurement endpoint for this assessment endpoint is a comparison of the calculated total daily doses against target receptor TRVs using tree swallow stomach contents measured directly as the dietary intake component. The TRVs used are NOAEL-based benchmarks from Sample *et al*. (1996).

4.6 WEIGHT-OF-EVIDENCE (WOE) DOCUMENTATION

The risks to the target receptor groups identified above were assessed using a weight of evidence (WOE) approach (Menzie et al., 1996). This method recognizes that all measurement endpoints do not carry the same weight when it comes to determining ecological risk. Some endpoints are quite qualitative (comparisons with benchmarks) while some are more quantitative (sediment toxicity testing). Risks associated with the more qualitative endpoints are considered less significant than those associated with more quantitative endpoints.

It is therefore important to assign a relative "weight" to the various measurement endpoints selected for assessment endpoint before those endpoints are used in risk characterization. Menzie et al. (1996) describe ten different attributes which, when taken together, can help determine the relative importance of each measurement endpoint. Table 8 summarizes the

BERA endpoints and provides the WOE scoring. The final risk step for each assessment endpoint incorporated the WOE score with the level of risk identified for each measurement endpoint to determine the potential for and significance of risk to the various assessment endpoints.

5.0 ECOLOGICAL EXPOSURE ASSESSMENT

5.1 INTRODUCTION

The ecological exposure assessment involves an estimate of the magnitude of exposure for selected ecological receptors based on the exposure pathways identified in the previous section. In the exposure assessment, the amount of COPCs in environmental media to which receptors are exposed is estimated. In this BERA, exposure point concentrations (EPC) were established for surface water, sediment, and biological tissues in Grove Pond and Plow Shop Pond.

The exposure assessment discusses how chemical exposures in Grove Pond and Plow Shop Pond were measured or modeled for the receptors for which assessment and measurement endpoints were developed: water column invertebrates, sediment biota, fish, mammals and birds.

5.2 CALCULATING ECOLOGICAL EXPOSURES

5.2.1 Water Column Invertebrates

Water column invertebrates are exposed to COPC throughout the water column via direct contact with surface water in the ponds. An estimate of potential exposure was provided by establishing maximum and average EPCs for each surface water COPC. These are shown in Table 9 (Grove Pond) and Table 10 (Plow Shop Pond). To calculated average EPCs, ½ the detection limit was used for non-detected values.

5.2.2 Benthic Invertebrates

Benthic invertebrates are exposed to COPC via direct contact generally within the top few inches of sediment in the ponds. An estimate of potential exposure was provided by establishing maximum and average EPCs in sediment for each sediment COPC. These are shown in Table 11 (Grove Pond) and Table 12 (Plow Shop Pond). To calculated average EPCs, ½ the detection limit was used for non-detected values.

Exposure in invertebrate organisms was also assessed by measuring concentrations of bioaccumulated COPC in tissues. As discussed in Section 3.2.1, in Grove Pond, six crayfish samples were collected in 1998 and 2000 and analyzed for metals. The three crayfish samples from 2000 were actually composite samples and the exact number of crayfish collected was not reported. Four composite odonata samples were collected in 2001 and analyzed for metals. Data from these crayfish and odonata samples are presented in Appendix A. As discussed in Section 3.2.2, in Plow Shop Pond, six mussel samples were collected in 1998 and analyzed for metals. Five crayfish samples were collected in 1998 and 2000 and analyzed for metals. The four crayfish samples from 2000 were actually composite samples and the exact number of crayfish collected was not reported. Four composite odonata samples were collected in 2000 and analyzed for metals. Data from these mussel and crayfish samples are presented in Appendix B. Tissue EPCs, which were compared against the CBRs, as discussed in Section 6 of the BERA, were derived from the maximum and average concentrations presented in Appendix A and B.

5.2.3 Fish

Fish are exposed to COPC throughout the water column via direct contact with surface water in the ponds. An estimate of potential exposure was provided by establishing maximum and average EPCs for each surface water COPC. These are shown in Table 9 (Grove Pond) and Table 10 (Plow Shop Pond). To calculated average EPCs, ½ the detection limit was used for non-detected values.

Exposure in fish was also assessed by measuring concentrations of bioaccumulated COPC in fish tissue. As discussed in Section 3.2.1, in Grove Pond thirty- two fish samples were collected in 1992 and 2004 and analyzed for metals, pesticides, and PCBs. Data from these fish samples are presented in Appendix A. As discussed in Section 3.2.2, in Plow Shop Pond, nineteen fish samples were collected in 1992 and 2004 and analyzed for metals, pesticides, and PCBs. Data from these fish samples are presented in Appendix B. Tissue EPCs, which were compared against the CBRs, as discussed in Section 6 of the BERA, were derived from the maximum and average concentrations presented in Appendix A and B.

5.2.4 Wildlife Exposures

5.2.4.1 Qualitative description of the wildlife food chain models

The total daily dose, in mg/kg_{bw}-$_{day}$, is an estimate of the amount of a COPC to which a bird or mammal receptor is exposed through ingestion of dietary items (e.g., fish, invertebrates, frogs, and bird eggs) and water, as well as incidental ingestion of sediment for some receptors. Maximum and average EPCs for dietary components were determined when possible from concentrations measured directly in Grove Pond and Plow Shop Pond abiotic and biological media. For surface water, while concentrations of dissolved metals were used for comparisons with benchmarks, the food chain modeling used the maximum concentrations of either dissolved or total metals. Fish, aquatic invertebrate, frog, tree swallow egg, and tree swallow stomach content data were taken from previous studies, as listed in Section 3.0, and supplemented with fish tissue data collected by EPA in 2004.

For COPC not measured directly in aquatic invertebrate tissue, concentrations in sediments were used with literature biota-sediment accumulation factors (BSAF) to model EPCs in invertebrate tissue. Similarly, all plant EPCs were estimated using sediment concentrations with plant uptake factors (PUF). The BSAF and PUF used in this Ecological Risk Assessment are shown in Table

13 (Grove Pond) and Table 14 (Plow Shop Pond). Literature BSAF are not available for frogs or tree swallow eggs; therefore, for COPC not directly measured in frogs and tree swallow eggs, EPCs for these dietary items were assumed equal to those for aquatic invertebrates. Abiotic and biological EPCs in Grove Pond are shown in Table 15 (maximum EPCs) and Table 16 (Average EPCs). Abiotic and biological EPCs in Plow Shop Pond are shown in Table 17 (maximum EPCs) and Table 18 (Average EPCs).

5.2.4.1.1 Omnivorous Mammal - Raccoon

The Exposure Estimate Equation for the raccoon is:

Exposure (mg/kg-d) =

$$\frac{[FIR[(EPC_{FI} \times FI) + (EPC_{IN} \times IN) + (EPC_{FR} \times FR) + (EPC_{EG} \times EG) + (EPC_{PL} \times PL) + (EPC_{SD} \times SD)] + (EPC_{WI} \times WI)] \times AUF}{BW}$$

Where:

FIR	=	Food ingestion Rate (kg/d)
EPC_{FI}	=	EPC in fish tissue (mg/kg)
FI	=	proportion of raccoon diet consisting of fish (unitless)
EPC_{IN}	=	EPC in invertebrate tissue (mg/kg)
IN	=	proportion of raccoon diet consisting of invertebrates (unitless)
EPC_{FR}	=	EPC in frog tissue (mg/kg)
FR	=	proportion of raccoon diet consisting of frogs (unitless)
EPC_{EG}	=	EPC in swallow eggs (mg/kg)
EG	=	proportion of raccoon diet consisting of swallow eggs (unitless)
EPC_{PL}	=	EPC in plant tissue (mg/kg)
PL	=	proportion of raccoon diet consisting of plants (unitless)
EPC_{SD}	=	EPC in sediment (mg/kg)
SD	=	proportion of raccoon diet consisting of incidental sediment ingestion (unitless)
EPC_{WI}	=	EPC in surface (mg/L)
WI	=	water consumption rate (L/d)
AUF	=	area use factor (unitless)
BW	=	body weight (kg)

The exposure equation for the raccoon includes ingestion of aquatic biota, sediment, and surface water. To incorporate the available site-specific data collected in Grove Pond and Plow Shop Pond, the diet of the omnivorous raccoon was assumed to consist equally of fish, invertebrates, frogs, eggs, and plants. Values for the above exposure parameters are provided in Table 19.

5.2.4.1.2 Piscivorous Mammal - Mink

The Exposure Estimate Equation for the mink is:

Exposure (mg/kg-d) =

$$\frac{[FIR[(EPC_{FI} \times FI) + (EPC_{SD} \times SD)] + (EPC_{WI} \times WI)] \times AUF}{BW}$$

Where:

FIR = Food ingestion Rate (kg/d)
EPC_{FI} = EPC in fish tissue (mg/kg)
FI = proportion of mink diet consisting of fish (unitless)
EPC_{SD} = EPC in sediment (mg/kg)
SD = proportion of mink diet consisting of incidental sediment ingestion (unitless)
EPC_{WI} = EPC in surface (mg/L)
WI = water consumption rate (L/d)
AUF = area use factor (unitless)
BW = body weight (kg)

In order to represent piscivorous mammals, the mink is assumed to be 100% piscivorous. The exposure equation for the mink, therefore, includes ingestion of fish, sediment, and surface water only. Values for the above exposure parameters are provided in Table 19.

5.2.4.1.3 Carnivorous Bird - Black-Crowned Night Heron

The Exposure Estimate Equation for the black-crowned night heron is:

Exposure (mg/kg-d) =

$$\frac{[FIR[(EPC_{FI} \times FI) + (EPC_{IN} \times IN) + (EPC_{FR} \times FR) + (EPC_{SD} \times SD)] + (EPC_{WI} \times WI)] \times AUF}{BW}$$

Where:

FIR = Food ingestion Rate (kg/d)
EPC_{FI} = EPC in fish tissue (mg/kg)
FI = proportion of black-crowned night heron diet consisting of fish (unitless)
EPC_{IN} = EPC in invertebrate tissue (mg/kg)
IN = proportion of black-crowned night heron diet consisting of invertebrates (unitless)
EPC_{FR} = EPC in frog tissue (mg/kg)
FR = proportion of black-crowned night heron diet consisting of frogs (unitless)

EPC_{SD} = EPC in sediment (mg/kg)
SD = proportion of black-crowned night heron diet consisting of incidental sediment ingestion (unitless)
EPC_{WI} = EPC in surface (mg/L)
WI = water consumption rate (L/d)
AUF = area use factor (unitless)
BW = body weight (kg)

The exposure equation for the black-crowned night heron includes ingestion of aquatic biota, sediment, and surface water. To incorporate the available site-specific data collected in Grove Pond and Plow Shop Pond, the diet of the carnivorous black-crowned night heron was assumed to consist equally of fish, invertebrates, and frogs. Values for the above exposure parameters are provided in Table 19.

5.2.4.1.4 Piscivorous Bird - Belted Kingfisher

The Exposure Estimate Equation for the belted kingfisher is:

Exposure (mg/kg-d) =

$$\frac{[FIR(EPC_{FI} \times FI) + (EPC_{WI} \times WI)] \times AUF}{BW}$$

Where:

FIR = Food ingestion Rate (kg/d)
EPC_{FI} = EPC in fish tissue (mg/kg)
FI = proportion of belted kingfisher diet consisting of fish (unitless)
EPC_{WI} = EPC in surface (mg/L)
WI = water consumption rate (L/d)
AUF = area use factor (unitless)
BW = body weight (kg)

In order to represent piscivorous birds, the belted kingfisher is assumed to be 100% piscivorous. The exposure equation for the belted kingfisher, therefore, includes ingestion of fish and surface water only. Values for the above exposure parameters are provided in Table 19.

5.2.4.1.5 Insectivorous Bird - Tree Swallow

The Exposure Estimate Equation for the tree swallow is:

Exposure (mg/kg-d) =

$$\frac{FIR(EPC_{ST}) \times AUF}{BW}$$

Where:

FIR = Food ingestion Rate (kg/d)
EPC_{ST} = EPC in stomach contents (food boli) (mg/kg)
AUF = area use factor (unitless)
BW = body weight (kg)

Tree swallow stomach contents were analyzed in Haines and Longcore (2001) for a limited suite of inorganic contaminants. Because it can be assumed that stomach contents represent all components of the diet, including ingestion of water and sediment, the only EPC used in this equation is that for stomach contents. Values for the above exposure parameters are provided in Table 19.

6.0 ECOLOGICAL EFFECTS ASSESSMENT

The effects assessment explains how a determination of risk was made given the expected exposure concentrations or doses identified in Section 5.0.

6.1 SELECTING MEASURES OF EFFECT

The effects assessment details the methods used to employ the measurement endpoints selected in Section 4.5.2. These endpoints included comparisons of site media concentrations to ecological benchmarks, comparisons with CBRs, toxicity testing of surface water and sediments, and food chain modeling for wildlife receptors.

6.2 METHODOLOGIES FOR ASSESSING TOXICITY

6.2.1 Selecting Measures of Effect for Water Column Invertebrates

Two measurement endpoints were selected for water column invertebrates: 1) a comparison of surface water concentrations with surface water benchmarks and 2) toxicity testing with surface water.

6.2.1.1 Benchmark Comparisons

Potential risk to aquatic organisms from COPC in surface water was evaluated through comparisons of site data with literature-derived toxicity thresholds for chronic and acute effects. The preferred benchmarks are EPA National Ambient Water Quality Criteria (NAWQC) - Criterion Continuous Concentration (CCC) and Criteria Maximum Concentration (CMC) benchmarks (EPA 2002). For chemicals that do not have corresponding NAWQC benchmarks, Tier II Secondary Chronic Values (SCV) and Secondary Acute Values (SAV) (Suter and Tsao 1996) were used for screening. These benchmarks are presented in Table 9 (Grove Pond) and Table 10 (Plow Shop Pond).

6.2.1.2 Toxicity Tests

In addition to a comparison with water quality benchmarks, risk to water column biota was determined by conducting surface water toxicity tests. In 2004, chronic toxicity tests were conducted with six Grove Pond surface water samples and six Plow Shop Pond surface water samples. An 8-day test was conducted with the freshwater cladoceran, *Ceriodaphnia dubia*, with survival and reproduction measured as endpoints. A sample from Flannagan Pond was included as a reference sample. The full toxicity test report is included as Appendix D.

6.2.2 Selecting Measures of Effect for Benthic Invertebrates

Three measurement endpoints were selected for benthic invertebrates: 1) a comparison of sediment concentrations with sediment benchmarks, 2) toxicity testing with sediment, and 3) a comparison of invertebrate tissue data with CBRs. An AVS/SEM evaluation was also conducted to assess the potential for bioavailability of metals in sediments.

6.2.2.1 Benchmark Screening

Potential risk to aquatic organisms from COPC in sediment was evaluated through comparisons of site data with literature-derived toxicity thresholds for low and severe effects. The hierarchy of benchmarks is as follows: EPA Sediment Quality Benchmarks (SQB), MacDonald *et al*. (2000) Threshold Effects Concentrations (TEC) and Probable Effects Concentrations (PEC); Ontario Ministry of the Environment Low-Effects Level (LEL) and Severe-Effects Level (SEL) benchmarks (Persaud *et al*. 1993); and NOAA Effects Range-Low (ER-L) and Effects Range-Median (ER-M) benchmarks (Long *et al*. 1995). These benchmarks are presented in Table 11 (Grove Pond) and Table 12 (Plow Shop Pond).

6.2.2.2 Toxicity Tests

In addition to a comparison with sediment benchmarks, risk to benthic invertebrates was determined by conducting sediment toxicity tests. In 2005, chronic toxicity tests were conducted with three Grove Pond sediment samples and 11 Plow Shop Pond sediment samples. Ten-day tests were conducted with the midge, *Chironomus tentans*, and the amphipod, *Hyallela azteca*. For both test species, survival and growth were measured as endpoints. A sample from Flannagan Pond was included as a reference sample. The full toxicity test report is included as Appendix D.

6.2.2.3 Critical Body Residue (CBR) Evaluation

A third approach for determining potential risk to benthic biota was a comparison of invertebrate body burdens to literature CBRs for invertebrates. In Grove Pond, while data for crayfish and odonata were collected, CBRs are only available for crayfish. The CBR comparison was made, therefore, with crayfish tissue data only. In Plow Shop Pond, while crayfish, mussel, and odonata samples were collected, CBRs were only available for crayfish and mussels. The CBR comparison was made, therefore, with crayfish and mussel tissue data only.

Maximum and average concentrations of chemicals measured directly in Grove Pond and Plow Shop Pond invertebrate samples were compared to CBRs as shown in Table 20. Both NOAEL and LOAEL CBRs were selected from the literature to obtain a range of potential risk estimates.

The source for CBRs was the US Army Corps of Engineers Environmental Residue-Effects Database (ERED).

6.2.2.4 Acid Volatile Sulfide/Simultaneously Extracted Metal Evaluation

The bioavailability of metals was also assessed with acid volatile sulfide (AVS) and simultaneously extracted metal (SEM) data. The AVS/SEM evaluation is not considered a measurement endpoint in a strict sense, however, as it does not provide an actual measurement or estimation of effects. It is, rather, a tool that is used to modify certain aspects of Measurement Endpoints 1 and 2, the assessment of risk posed by inorganic COPC.

To determine if inorganic chemicals in sediments are bioavailable, acid volatile sulfide (AVS) and simultaneously extracted metal (SEM) data were collected in Grove Pond and Plow Shop Pond. Samples were collected by EPA in 2005 and were collocated with samples used in sediment toxicity tests.

The AVS/SEM method for evaluating bioavailability is generally applied to divalent cations (i.e., copper, lead, cadmium, zinc, and nickel). Divalent metals in sediments bind to available AVS depending on metals solubility, the least soluble binding preferentially. These metals bind to available AVS and are sequentially converted to copper sulfide, lead sulfide, cadmium sulfide, zinc sulfide, and nickel sulfide as long as sulfides are available. When the molar sum of divalent cations, or SEM, is less than the molar concentration of available AVS, these metals exist as metal sulfides that are insoluble and not present in sediment pore water. Toxicity is reduced, therefore, in sediments with higher concentrations of AVS than SEM. Conversely, when SEM is greater than AVS, the portion of the SEM in excess of the AVS is potentially bioavailable and toxic.

6.2.3 Selecting Measures of Effect for Fish

Three measurement endpoints were selected for fish: 1) a comparison of surface water concentrations with benchmarks, 2) toxicity testing with surface water, and 3) a comparison of fish tissue data with CBRs.

6.2.3.1 Benchmark Comparisons

Potential risk to fish from COPC in surface water was evaluated through comparisons of site data with literature-derived toxicity thresholds for chronic and acute effects. These literature benchmarks were previously described in Section 4.5.2.1 and presented in Table 9 (Grove Pond) and Table 10 (Plow Shop Pond).

6.2.3.2 Toxicity Tests

In addition to a comparison with water quality benchmarks, risk to fish was determined by conducting surface water toxicity tests. In 2004, chronic toxicity tests were conducted with six Grove Pond surface water samples and six Plow Shop Pond surface water samples. A 7-day test was conducted with the fathead minnow, *Pimephales promelas*, with survival and growth as endpoints. A sample from Flannagan Pond was included as a reference sample. The full toxicity test report is included as Appendix D.

6.2.3.3 Critical Body Residue (CBR) Evaluation

A third approach for determining potential risk to fish was a comparison of whole body burdens to literature CBRs for fish. Maximum and average concentrations of chemicals measured directly in Grove Pond and Plow Shop Pond fish samples were compared to CBRs in fish as shown in Table 21 and Table 7. Both NOAEL and LOAEL CBRs were selected from the literature. The source for CBRs was the US Army Corps of Engineers Environmental Residue-Effects Database (ERED).

6.2.4 Selecting Measures of Effect for Wildlife Receptors

The exposure estimates for wildlife receptors calculated as described in Section 5.2.4 were compared to literature based toxicity reference values (TRV). Total daily doses were compared to literature TRVs to calculate the hazard quotient (HQ
To evaluate potential risks to wildlife receptors from the total daily dose of COPC, TRVs were used for each COPC for each avian and mammalian receptor. The TRV identifies potential adverse effects associated with a dose of a given COPC from oral exposure. The TRV effects reflect the assessment endpoint chosen for the protection of wildlife receptors. If no toxicity information is available for a COPC, and it was not possible to identify TRVs, risks associated with the estimated exposure for the respective COPCs cannot be quantitatively evaluated.

Mammalian TRVs are presented in Table 22 and avian TRVs are presented in Table 23. No observed adverse effects level (NOAEL) and lowest observed adverse effects level (LOAEL) TRVs were obtained primarily from Sample *et al*. (1996). Body weight scaling factors have generally been used for mammals to adjust TRVs based on a receptor's body weight relative to the body weight of the test species. This conversion is not accepted by the EPA Region 1 BTAG, however, and was not conducted for this ecological risk assessment.

7.0 ECOLOGICAL RISK CHARACTERIZATION

7.1 INTRODUCTION

Data on exposure and effects are integrated in the risk characterization to provide estimates of risk to biota of Grove Pond and Plow Shop Pond. The presence of potential risk was assessed for the various receptor groups evaluated in this BERA through several lines of evidence. For surface water invertebrates, potential risk was indicated if HQs based on surface water EPC and chronic and acute benchmarks exceeded 1.0 or if there were significant statistical responses in the toxicity tests. For benthic invertebrates, potential risk was indicated if HQs based on sediment EPC and chronic and acute benchmarks exceeded 1.0, if HQs based on invertebrate tissue EPCs and CBRs exceeded 1.0, or if there were significant statistical responses in the toxicity tests. For fish, potential risk was indicated if HQs based on surface water EPC and chronic and acute benchmarks exceeded 1.0, if HQs based on fish tissue EPCs and CBRs exceeded 1.0, or if there were significant statistical responses in the toxicity tests. For wildlife receptors, potential risk was indicated by HQs based on TDD and TRV greater than 1.0. Both NOAEL and LOAEL TRVs were used to obtain a range of risk values for each COPC. However, the potential for unacceptable risk was assumed to be present only if the average HQ_{LOAEL} exceeded 1.0.

The approach considered to be protective of the greatest number of species in an ecological assessment is the use of conservative criteria that incorporate assumptions likely to overestimate risk in the hazard quotient approach. Based on these assumptions and the above methods, a small number of organic and inorganic chemicals were identified to represent the most significant risk to ecological receptors in and around the ponds.

7.2 ASSESSMENT ENDPOINT 1: SURFACE WATER INVERTEBRATE COMMUNITY

The Assessment Endpoint was Protection of the long-term health of water column invertebrate populations from sublethal and lethal toxic effects of chemicals in surface waters. *Are the levels of contaminants in surface water sufficiently high to cause biologically significant changes or impair the function of the water column invertebrate community in Grove Pond and Plow Shop Pond?*

7.2.1 Measurement Endpoint A: Benchmarks Comparison

The first measurement endpoint involved comparing concentrations of surface water COPC to literature benchmarks for surface water. The resultant HQs for surface water are presented in Table 9 (Grove Pond) and Table 10 (Plow Shop Pond).

7.2.1.1 Grove Pond

Hazard quotients based on maximum EPC and chronic-effects benchmarks were greater than one but less than 10 for aluminum, barium, and manganese. Hazard quotients based on average EPC and chronic-effects benchmarks were slightly greater than one for barium and manganese. No HQs based on acute-effects benchmarks were greater than one.

Based on benchmark screening, there is low potential risk for aquatic biota from chronic exposures but not acute exposures to aluminum, barium and manganese in the water column.

7.2.1.2 Plow Shop Pond

Hazard quotients based on maximum EPC and chronic-effects benchmarks were greater than one but less than 10 for aluminum, barium, manganese, and selenium. Hazard quotients based on average EPC and chronic-effects benchmarks were slightly greater than one for barium, manganese, and selenium. No HQs based on acute-effects benchmarks were greater than one. Based on benchmark screening, there is low potential risk for aquatic biota from chronic exposures but not acute exposures to barium, manganese, and selenium in the water column.

7.2.2 Measurement Endpoint B: Surface Water Toxicity Testing

The second measurement endpoint for surface water invertebrates was surface water chronic toxicity test using the freshwater cladoceran (*Ceriodaphnia dubia*).

7.2.2.1 Grove Pond

To measure potential toxicity directly in Grove Pond surface water, toxicity tests were conducted as detailed in Section 6.2.1.2. Results of toxicity tests with surface water invertebrates are presented in Table 24. Full results of surface water toxicity tests are provided in Appendix D.

Neither survival nor any of the reproduction endpoints (average number of neonates per surviving brood, percent brooders with three or more broods, or average number of neonates for brooders with three or more broods) in *Ceriodaphnia dubia* were significantly affected relative to the reference sample. These results are not surprising given the general lack of exceedances of surface water benchmarks.

7.2.2.2 Plow Shop Pond

To measure potential toxicity directly in Plow Shop Pond surface water, toxicity tests were conducted as detailed in Section 6.2.1.2. Results of toxicity tests with surface water invertebrates are presented in Table 25. Full results of surface water toxicity tests are provided in Appendix D.

Neither survival nor any of the reproduction endpoints (average number of neonates per surviving brood, percent brooders with three or more broods, or average number of neonates for brooders with three or more broods) in *Ceriodaphnia dubia* were significantly affected relative to the reference sample. These results are not surprising given the general lack of exceedances of surface water benchmarks.

7.2.3 Water Column Invertebrate Community Weight of Evidence Integration

The WOE Integration results for water column invertebrates are identical for Grove Pond and Plow Shop Pond, so they are merged in this section.

Assessment Endpoint:
Protect the long-term health of water column invertebrates

Measurement Endpoints:
A. Compare surface water contaminant concentrations against surface water benchmarks
B. Assess surface water toxicity using C. dubia

Weight-of-Evidence Integration

	Weight (from Table 8)				
RISK/MAGNITUDE	Low	Low-Medium	Medium	Medium-High	High
Yes/High					
Yes/Medium					
Yes/Low		**A**			
Indeterminate					
No Risk			**B**		

Summary:

Two lines of evidence were used to assess the potential risk to the surface water invertebrate communities in Grove and Plow Shop Ponds. Comparing surface water COPC concentrations to generic benchmarks identified a potential for low risk, but with a low-medium WOE; measuring surface water toxicity using a sensitive invertebrate species identified no risk, with a medium WOE. Based on this evidence, no potential for significant risk to the surface water invertebrate communities in either Grove Pond or Plow Shop Pond appear to exist. .

7.3 ASSESSMENT ENDPOINT 2: BENTHIC INVERTEBRATE COMMUNITY

The Assessment Endpoint was protection of benthic macroinvertebrate communities from sublethal and lethal acute toxic effects of chemicals in sediments. *Are the levels of contaminants in sediments sufficiently high to cause biologically significant changes or impair the function of the benthic community in grove Pond or Plow Shop Pond?*

7.3.1 Measurement Endpoint A: Benchmarks Comparison

The first measurement endpoint involved comparing concentrations of sediment COPC to literature benchmarks for sediment. The resultant HQs for sediment are presented in Table 11 (Grove Pond) and Table 12 (Plow Shop Pond).

7.3.1.1 Grove Pond

Hazard quotients based on maximum sediment EPCs and chronic (low effect) ($HQ_{Max\text{-}chronic}$) benchmarks exceeded one for 16 metals, four pesticides, and 17 SVOC. Most of the $HQ_{Max\text{-}chronic}$ exceeded 10 and several were greater than 100. The highest $HQ_{Max\text{-}chronic}$ were for cadmium (737), chromium (1198) and mercury (2344).

Hazard quotients based on maximum sediment EPCs and acute (severe effect) ($HQ_{Max\text{-}acute}$) benchmarks exceeded one for 11 metals, three pesticides, and 10 SVOC. Six of the $HQ_{Max\text{-}acute}$ for metals exceeded 10, with those for cadmium (147), chromium (468), and mercury (398) being the highest. Three of the $HQ_{Max\text{-}acute}$ for pesticides also exceeded 10. Naphthalene (36) was the only SVOC with an $HQ_{Max\text{-}acute}$ greater than 10.

Hazard quotients based on average sediment EPCs and chronic (low effect) ($HQ_{Avg\text{-}chronic}$) benchmarks exceeded one for 14 metals, four pesticides, and 17 SVOC. Five of the $HQ_{Avg\text{-}chronic}$ for metals exceeded 10 with those for barium (118), cadmium (18), chromium (135) and mercury (122) being the highest. Three of the $HQ_{Avg\text{-}chronic}$ for pesticide also exceeded 10 but none of the $HQ_{Avg\text{-}chronic}$ for SVOC were greater than 10.

Hazard quotients based on average sediment EPCs and acute (severe effect) ($HQ_{Avg\text{-}acute}$) benchmarks exceeded one for five metals, with only chromium (53) and mercury (21) having HQs greater than 10. Three of the $HQ_{Avg\text{-}acute}$ for pesticide also exceeded one but only DDD (11) had an HQ greater than 10. Only one SVOC, naphthalene (1.3) had an $HQ_{Avg\text{-}acute}$ greater than one.

The results of the sediment benchmark comparisons suggest that there is potential for risk to benthic invertebrates throughout the pond from exposure to several inorganics, pesticides, and PAHs. The potential for severe risk is also possible but limited to a smaller number of COPCs and may be localized near known source areas (e.g., within Tannery Cove). The most significant sever-effect levels are potentially associated with chromium, mercury, and DDD as the average concentration of all Grove Pond sediment samples exceeded the benchmarks for severe effects by a large margin for these chemicals.

7.3.1.2 Plow Shop Pond

Hazard quotients based on maximum sediment EPCs and chronic (low effect) ($HQ_{Max\text{-}chronic}$) benchmarks exceeded one for 16 metals, three pesticides, two PCBs, 17 SVOC, and one VOC. Most of the $HQ_{Max\text{-}chronic}$ exceeded 10 and several were greater than 100. The highest $HQ_{Max\text{-}chronic}$ were for arsenic (695), chromium (871), mercury (1389), and DDE (411).

Hazard quotients based on maximum sediment EPCs and acute (severe effect) ($HQ_{Max\text{-}acute}$) benchmarks exceeded one for 10 metals, three pesticides, and 12 SVOC. Six of the $HQ_{Max\text{-}acutec}$ for metals exceeded 10, with those for arsenic (206), chromium (341), and mercury (236) being the highest. The $HQ_{Max\text{-}acute}$ for DDD (64) and DDE (42) also exceeded 10. None of the $HQ_{Max\text{-}acute}$ for SVOC exceeded 10.

Hazard quotients based on average sediment EPCs and chronic (low effect) ($HQ_{Avg\text{-}chronic}$) benchmarks exceeded one for 14 metals, three pesticides, one PCB, and 17 SVOC. Five of the $HQ_{Avg\text{-}chronic}$ for metals exceeded 10 with those for arsenic (55), barium (144), chromium (52) and mercury (150) being the highest. Two of the $HQ_{Avg\text{-}chronic}$ for pesticide also exceeded 10 and one of the $HQ_{Avg\text{-}chronic}$ for SVOC was greater than 10.

Hazard quotients based on average sediment EPCs and acute (severe effect) ($HQ_{Avg\text{-}acute}$) benchmarks exceeded one for seven metals, with only arsenic (16), chromium (20) and mercury (25) having HQs greater than 10. Two of the $HQ_{Avg\text{-}acute}$ for pesticide also exceeded one but only slightly. Similarly, two of the $HQ_{Avg\text{-}acute}$ for SVOC exceeded one but only slightly.

The results of the sediment benchmark comparisons suggest that there is potential for risk to benthic invertebrates throughout the pond from exposure to several inorganics, pesticides, and PAHs. The potential for severe risk is also possible but limited to a smaller number of COPCs. . The most significant sever-effect levels are potentially associated with arsenic, chromium, and mercury as the average concentration of all Plow Shop Pond sediment samples exceeded the benchmarks for severe effects by a large margin for these chemicals.

7.3.2 Measurement Endpoint B: Sediment Toxicity Testing

The second measurement endpoint for benthic invertebrates was sediment toxicity testing using a midge (*Hyallela azteca*) and an amphipod (*Chironomus tentans*)

7.3.2.1 Grove Pond

To measure potential toxicity directly in Grove Pond sediment, toxicity tests were conducted as detailed in Section 6.2.2.2. Toxicity test results and a presentation of sediment chemistry in toxicity test samples are presented in Table 26. The full toxicity test report is included in Appendix D. Results of the sediment toxicity tests suggest that COPC in Grove Pond may cause chronic toxicity in benthic invertebrates.

In a ten-day exposure, *Hyallela azteca* did not experience increased mortality relative to the Flannagan Pond reference location. Growth in *H. azteca* was negatively affected, however, in one sample, Grove-Sed-3 (in the Tannery Cove area). The average biomass in this sample was 0.07 mg dry weight (dw), which was significantly less than that at the reference site (0.111 mg dw).

Similarly, survival in *C. tentans* was not significantly affected in Grove Pond samples. Growth, however, was affected in sample Grove-Sed-2 (south of Tannery Cove), with average biomass in the sample (0.81 mg dw) significantly lower than that in the reference sample (0.95 mg dw).

An evaluation of toxicity test results and associated chemical concentrations does not reveal a clear culprit causing the observed effects in the two samples. In Grove-Sed-3, the only sample in which an effect on H. azteca growth was observed, seven inorganics were detected at concentrations higher than in samples where toxicity was not observed and exceeding benchmarks (five exceeded severe effect benchmarks). Two pesticides, DDD, and DDE were also detected in this sample at concentrations higher than in the other samples and exceeding severe effect benchmarks.

In Grove-Sed-2, the only sample in which an effect on *C. tentans* growth was observed, seven inorganics were detected at concentrations greater than benchmarks (three exceeded severe effect benchmarks). Several PAHs also exceeded benchmarks, as did DDE. None of these metals or organic chemicals was detected at concentrations greater than in the other samples.

While one or more of these chemicals may be responsible for the observed effect in *H. azteca* and *C. tentans*, the results are somewhat ambiguous given that negative effects were not observed in *C. tentans* in Grove-Sed-3 or in *H. azteca* in Grove-Sed-2. Given that the COPC concentrations did not generate toxic responses consistently, and given that the effects, while statistically significant, were not great in magnitude, these results may not equate to unacceptable risk for benthic invertebrates. Overall, the potential risk associated with this measurement endpoint is considered medium based on observed sublethal responses in two of the three sediment samples from Grove Pond.

7.3.2.2 Plow Shop Pond

To measure potential toxicity directly in Plow Shop Pond sediment, toxicity tests were conducted as detailed in Section 6.2.2.2. Toxicity test results and a presentation of sediment chemistry in toxicity test samples are presented in Table 27. The full toxicity test report is included in Appendix D. Results of the sediment toxicity tests suggest that COPC in Plow Shop Pond may cause chronic lethal and sublethal toxicity in benthic invertebrates.

In a ten-day exposure, *Hyallela azteca* experienced a significant decrease in survival (49% survival) in one sample (Plow-Sed-9) relative to the Flannagan Pond reference location (95% survival). Further, growth in *H. azteca* was negatively affected in six samples, Plow-Sed-1 through Plow-Sed-4, Plow-Sed-9, and Plow-Sed-11, relative to the reference sample. The average biomass (dry weight) in these samples was 0.08 mg, 0.075 mg, 0.075 mg, 0.065 mg, 0.033 mg, and 0.078 mg, respectively. All weights were significantly less than that at the reference site (0.111 mg).

Survival in *C. tentans* was also significantly decreased in Plow-Sed-9 (45% survival) relative to the reference sample (100% survival). In addition, *C. tentans* growth was negatively affected in Plow-Sed-9 but not in any other samples. Average dry biomass in the sample (0.082 mg) was significantly lower than that in the reference sample (0.95 mg).

An evaluation of toxicity test results and associated chemical concentrations reveals a clear pattern for one sample but less clear results for other samples. Sediment was consistently toxic in Plow-Sed-9, adjacent to the Railroad Roundhouse. The most likely cause of toxicity in this sample is PAHs. Concentrations of PAHs were greater than low-effect and severe-effect benchmarks and were much higher than in other samples. PAHs in this area present unacceptable risk to benthic invertebrates.

In addition to the toxic effects observed adjacent to the Railroad Roundhouse, significant effects on *H. azteca* growth were observed in five samples along the western shore of Plow Shop Pond. Arsenic, barium, and manganese exceeded benchmarks and were consistently higher in these samples than in the samples in which no significant effects were observed. High concentrations of iron were also detected in these samples. While iron is not generally considered toxic, high enough concentrations may present a problem in the form of a flocculent, which may, for example, deprive benthos of oxygen. Finally, mercury was detected in Plow-Sed-1 at a concentration (93 mg/kg) greater than in samples where toxicity was not observed. Mercury may play a role, therefore, in the toxic response observed in this sample.

While one or more of the above chemicals may be responsible for the observed effect in *H. azteca*, the concentrations, other than PAHs in Plow-Sed-9, did not cause a toxic response in *C. tentans*. Because of this inconsistency in the response in different test organisms, the results may not generally lead to unacceptable risk for benthic invertebrates. Overall, the potential risk associated with this measurement endpoint is considered medium based on observed sublethal responses in five of 11 sediment samples from Plow Shop Pond. Acute toxicity was observed in an additional sample but appears to be confined to a small area affected by high levels of PAHs.

Results of Previous Toxicity Tests

Toxicity tests were conducted previously with Plow Shop Pond sediments and porewater collected in 1994 (ABB-ES 1995). Three separate test methods were used. Methods followed ASTM (1993) guidelines, which are consistent with the EPA (1994) Guidelines and the EPA's Contaminated Sediment Management Strategy (EPA 1998). The following is a list of tests conducted with results summarized:

10-day chronic pore water exposure with *Ceriodaphnia dubia*
- Used porewater from 22 sediment samples.
- Significant mortality in 9 of 22 locations.

10-day acute exposure with *Hyalella azteca*
- Reduced survival in 6 of 10 sediment samples

10-day subchronic exposure with *Chironomus tentans*
- Reduced survival at one of 22 locations throughout Plow Shop Pond.
- Growth reduction at several locations

These results are presented here not to enhance the risk characterization but to provide some perspective on past conditions relative to current conditions. For surface water invertebrates, for example, the previous results revealed significant mortality. The 2004 surface water toxicity test results showed no toxicity in Plow Shop Pond surface water. While the 1994 tests revealed significant risk to the same surface water organism, the test was conducted with porewater, rather than surface water. There was a decrease in toxicity to *C. dubia*, but the comparability of these results is questionable.

For *hyalella azteca*: The results of the 2005 toxicity testing revealed decreased survival in one of 11 samples and decreased growth in 6 of 11 samples. The previous results revealed decreased survival in 6 of 10 samples. Based on these results, there has been an apparent decrease in toxicity to *H. azteca* in the past 10 years in Plow Shop Pond sediment. This comparison is uncertain, however, because a comparison between sample locations was not made.

For *Chironomus tentans*, the results of the 2005 toxicity testing revealed decreased survival in one of 11 samples as well as decreased growth in one of 11 samples. The previous results revealed in only one sample also but decreased growth in several locations. Based on these results, there has been an apparent decrease in sub-lethal toxicity to *C. Tentans* in the past 10 years in Plow Shop Pond sediment. This comparison is uncertain, however, because a comparison between sample locations was not made.

7.3.3 Measurement Endpoint C: Critical Body Residue (CBR) Evaluation

The third measurement endpoint for determining potential risk to benthic biota was a comparison of invertebrate body burdens to literature CBRs for invertebrates, as discussed in Section 6.2.2.3.

7.3.3.1 Grove Pond

Hazard quotients for Grove Pond crayfish are shown in Table 27. Comparisons were made between maximum and average EPCs and both NOAEL and LOAEL CBRs.

Hazard quotients based on maximum EPCs and NOAEL CBRs ($HQ_{Max\text{-}NOAEL}$) were greater than one for five metals, with that for manganese (56) being the only HQ much greater than one. Hazard quotients based on average EPCs and NOAEL CBRs ($HQ_{Avg\text{-}NOAEL}$) were greater than one for three metals, with that for manganese (46) being the only HQ much greater than one. Hazard quotients based on maximum EPCs and LOAEL CBRs ($HQ_{max\text{-}LOAEL}$) were greater than one for chromium (1.1) and manganese (17). Finally Hazard quotients based on average EPCs and LOAEL CBRs ($HQ_{Avg\text{-}LOAEL}$) were greater than one only for manganese (16).

The results of the CBR comparison for Grove Pond crayfish suggest that manganese is the only metal that may potentially pose unacceptable risk to crayfish from accumulated body burdens. There is low confidence, however, in the manganese CBR for crayfish because the CBR was derived from toxicity data for a saltwater clam. Given that none of the other COPC pose unacceptable risk to the crayfish in Grove Pond from accumulated body burdens is probably low. Further, the low sample size (n=3) adds uncertainty to the risk evaluation.

7.3.3.2 Plow Shop Pond

Hazard quotients for Plow Shop Pond crayfish and mussels are shown in Table 28. Comparisons were made between maximum and average EPCs and both NOAEL and LOAEL CBRs.

<u>Crayfish</u>

Hazard quotients based on maximum EPCs and NOAEL CBRs ($HQ_{Max\text{-}NOAEL}$) were greater than one for four metals, with that for manganese (18) being the only HQ much greater than one. Hazard quotients based on average EPCs and NOAEL CBRs ($HQ_{Avg\text{-}NOAEL}$) were greater than one for three metals, with that for manganese (18) being the only HQ much greater than one. Hazard quotients based on maximum EPCs and LOAEL CBRs ($HQ_{max\text{-}LOAEL}$) and those based on average EPCs and LOAEL CBRs ($HQ_{Avg\text{-}LOAEL}$) were greater than one only for manganese (6).

The results of the CBR comparison for Plow Shop Pond crayfish suggest that manganese is the only metal that may pose unacceptable risk to crayfish from accumulated body burdens. There is low confidence, however, in the manganese CBR for crayfish because the CBR was derived from toxicity data for a saltwater clam. Given that none of the other COPC pose unacceptable risk to the crayfish in Plow Shop Pond from accumulated body burdens is probably low. Further, the low sample size (n=1) adds uncertainty to the risk evaluation.

<u>Mussels</u>

Hazard quotients for metals were less than one, except for manganese, for which the following HQs were calculated: $HQ_{Max\text{-}NOAEL}$ (67), $HQ_{Avg\text{-}NOAEL}$ (48), $HQ_{max\text{-}LOAEL}$ (22), and $HQ_{Avg\text{-}LOAEL}$ (16).

The results of the CBR comparison for Plow Shop Pond mussels reveal that manganese is the only metal that may pose unacceptable risk to mussels from accumulated body burdens. There is low confidence, however, in the manganese CBR for mussels because the CBR was derived from toxicity data for a saltwater clam, rather than a freshwater bivalve. Given that none of the other COPC pose unacceptable risk to the mussel in Plow Shop Pond from accumulated body burdens is probably low.

7.3.4 AVS/SEM Evaluation

The potential effects of metals on benthic organisms can be further evaluated using the AVS/SEM data. As stated in Section 6.2.2.4, The AVS/SEM evaluation is not considered a measurement endpoint in a strict sense, but can be used to modify the evaluation of risk based on benchmark screening and toxicity testing.

7.3.4.1 Grove Pond

Results of the AVS/SEM analysis for Grove Pond are presented in Table 29. In all three Grove Pond samples, the SEM:AVS ratio was greater than one, and the difference of SEM-AVS was greater than zero. In the Flannagan Pond sample the SEM:AVS ratio was less than one.

Generally, when the SEM:AVS ratio is greater than one, this suggests that some or all divalent metals may be bioavailable. In the case of the three Grove Pond samples, however, the one metal that drives the SEM to exceed AVS is chromium. While chromium was included in the SEM analysis, EPA (2005) suggests that chromium not be included among the SEM metals because its interaction with AVS is not via formation of an insoluble sulfide. The sum of other SEM metals is less than the AVS concentration, suggesting that AVS in Grove Pond is sufficient to bind these metals and render them unavailable to aquatic organisms.

The highly elevated concentrations of chromium, particularly in Grove-Sed-3 (38,000 mg/kg), may not pose a toxic hazard for a reason other than sequestration by AVS. Chromium generally exists in two states in the environment, the relatively insoluble and nontoxic CrIII and the more soluble and toxic CrVI. Chromium VI is thermodynamically unstable in anoxic sediments (EPA 2005). The AVS concentrations in Grove Pond sediments highlight the anoxic conditions, which probably prevent the occurrence of Chromium VI. This assertion is supported by the surface water data. Dissolved chromium was detected in only two surface water samples in Grove Pond and at concentrations below the chronic benchmark.

7.3.4.2 Plow Shop Pond

Results of the AVS/SEM analysis for Plow Shop Pond are presented in Table 30. In all but four Plow Shop Pond sediment samples, SEM:AVS ratio was less than one, and the SEM-AVS difference was below zero. The exceptions were in samples for in chromium drove the SEM to exceed AVS. As discussed in the previous paragraph, while chromium was included in the SEM analysis, EPA (2005) suggests that chromium not be included among the SEM metals because its interaction with AVS is not via formation of an insoluble sulfide. Eliminating chromium from the SEM sum, all SEM:AVS ratios were less than one. In the Flannagan Pond sample the SEM:AVS ratio was less than one. These results suggest that AVS in Plow Shop Pond is sufficient to bind these metals and render them unavailable to aquatic organisms.

The highly elevated concentrations of chromium, particularly in Plow-Sed-1 (6200 mg/kg), may not pose a toxic hazard for a reason other than sequestration by AVS. The AVS concentrations in Plow Shop Pond sediments demonstrate the anoxic conditions, which probably maintain chromium in the Cr III form, rather than Cr VI (see technical explanation for Grove Pond chromium in Section 7.3.4.1). This assertion is supported by the surface water data. Dissolved chromium was only detected in the six samples collected for surface water toxicity tests and at concentrations well below chronic benchmarks.

7.3.5 Previous Benthic Invertebrate Community Risk Characterization

As part of the Addendum RI (ABB-ES 1993), a semi-quantitative survey of macroinvertebrates was conducted at three sampling locations in Plow Shop Pond in 1992. Three sediment samples were collected on the southeast, south, and southwest edges of the pond, and were analyzed for pesticides/PCBs, inorganics, TOC, and grain size. A Rapid Bioassessment Protocol (RBP) metric comparison was conducted to evaluate the community. Results indicated that the benthic community in Plow Shop Pond was slightly affected versus the reference site, New Cranberry Pond, with diversity increasing with distance from the Shepley's Hill Landfill area. Arsenic, Cu, Fe, Mn, and Hg were identified as the primary chemicals of concern for benthic invertebrates.

The results parallel, to a degree, the findings the 2004 toxicity tests, which, besides the more significant toxicity near the Railroad Roundhouse, demonstrated moderate toxicity for *H. azteca* from exposure to chemicals (particularly, As, Fe, and Mn) in Red Cove and along the western shore of the pond.

Results of the historic benthic survey should only be incorporate as a piece of evidence with limited confidence. There were major uncertainties with the macroinvertebrate survey results, primarily based on the limited numbers of samples and suitability of the reference pond.

7.3.6 Benthic Invertebrate Community Weight of Evidence Integration

7.3.6.1 Grove Pond

Assessment Endpoint:
Protect the integrity of the local macroinvertebrate benthic community

Measurement Endpoints:
A. Compare sediment contaminant concentrations against sediment benchmarks
B. Assess sediment toxicity testing using H. azteca and C. tentans.
C. Compare crayfish tissue residue levels against target receptor toxicity reference values (CBRs)

Weight-of-Evidence Integration

	Weight (from Table 8)				
Risk/MAGNITUDE	Low	Low-Medium	Medium	Medium-High	High
Yes/High		**A**			
Yes/Medium				**B**	
Yes/Low				**C**	
Indeterminate					
No Risk					

Summary:

Three lines of evidence were used to assess the potential risk to benthic invertebrates in Grove Pond. Comparing measured bulk chemistry concentrations to generic sediment benchmarks identified a high potential for risk, but with a low-medium WOE; measuring sediment toxicity using two benthic invertebrate species identified a medium potential for risk, with a medium-high WOE; comparing measured tissue residue levels in crayfish to generic CBRs identified a low potential for risk, with a medium-high WOE. Overall, the available data indicate that there is the potential for significant risk to the benthic invertebrate community in Grove Pond.

On the other hand, the thick vegetative mat may act as a barrier between COPCs in sediments and the local benthic invertebrate community. As such, high concentrations in the sediment may not be fully available to biota, resulting in lower toxic effects than anticipated based on bulk sediment concentrations. The AVS/SEM evaluation also suggests that many of the divalent metals may not be bioavailable in the pond sediment

7.3.6.2 Plow Shop Pond

Assessment Endpoint:
Protect the integrity of the local macroinvertebrate benthic community

Measurement Endpoints:
A. Compare sediment contaminant concentrations against sediment benchmarks
B. Assess sediment toxicity testing using H. azteca and C. tentans.
C. Compare mussel and crayfish tissue residue levels against target receptor toxicity reference values (CBRs)

Weight-of-Evidence Integration

	Weight (from Table 8)				
Risk/MAGNITUDE	Low	Low-Medium	Medium	Medium-High	High
Yes/High		**A**			
Yes/Medium				**B**	
Yes/Low				**C**	
Indeterminate					
No Risk					

Summary:

As with Grove Pond, three lines of evidence were used to assess the potential risk to benthic invertebrates in Plow Shop Pond. Comparing measured bulk chemistry concentrations to generic sediment benchmarks identified a high potential for risk, but with a low-medium WOE; measuring sediment toxicity using two benthic invertebrate species identified a medium potential for risk, with a medium-high WOE; comparing measured tissue residue levels in crayfish and freshwater clams to generic CBRs identified a low potential for risk, with a medium-high WOE. Overall, the available data indicate that there is potential for significant risk to the benthic invertebrate community in Plow Shop Pond. Depending on the COPC, risk for these receptors tends to be greater near the various source areas. Toxicity testing and a semi-quantitative macroinvertebrate survey performed in the early 1990's support the evidence for potential risk to the benthic invertebrate community in Plow Shop Pond. .

7.4 ASSESSMENT ENDPOINT 3: FISH COMMUNITY

The Assessment Endpoint was protection of the long-term health of local fish populations from sublethal and lethal toxic effects of chemicals in surface waters. *Are the levels of contaminants within Grove Pond and Plow Shop Pond sufficiently high to cause biologically significant changes or impair the function of the warm water fish community?*

7.4.1 Measurement Endpoint A: Benchmarks Comparison

The first measurement endpoint involved comparing concentrations of surface water COPC to literature benchmarks for surface water. The resultant HQs for surface water are presented in Table 9 (Grove Pond) and Table 10 (Plow Shop Pond).

7.4.1.1 Grove Pond

Hazard quotients based on maximum EPC and chronic-effects benchmarks were greater than one but less than 10 for aluminum, barium, and manganese. Hazard quotients based on average EPC and chronic-effects benchmarks were slightly greater than one for barium and manganese. No HQs based on acute-effects benchmarks were greater than one.

Based on benchmark screening, there is low potential risk for fish in Grove Pond from chronic exposures but not acute exposures to aluminum, barium and manganese in the water column.

7.4.1.2 Plow Shop Pond

In Plow Shop Pond, HQs based on maximum EPC and chronic-effects benchmarks were greater than one but less than 10 for aluminum, barium, manganese, and selenium. Hazard quotients based on average EPC and chronic-effects benchmarks were slightly greater than one for barium, manganese, and selenium. No HQs based on acute-effects benchmarks were greater than one.

Based on benchmark screening, there is low potential risk for fish in Plow Shop Pond from chronic exposures but not acute exposures to barium, manganese, and selenium in the water column.

7.4.2 Measurement Endpoint B: Surface Water Toxicity Testing

The second measurement endpoint for fish was surface water chronic toxicity test using the fathead minnow (*Pimephales promelas*).

7.4.2.1 Grove Pond

To measure potential toxicity directly in Grove Pond surface water, toxicity tests were conducted as detailed in Section 6.2.3.1. Results are presented in Table 31. Full results of surface water toxicity tests are provided in Appendix D.

Neither survival nor the two growth endpoints (average dry biomass and average dry weight) were significantly affected in *Pimephales promelas* exposed to Grove Pond water. These results are not surprising given the general lack of exceedances of surface water benchmarks.

7.4.2.2 Plow Shop Pond

To measure potential toxicity directly in Plow Shop Pond surface water, toxicity tests were conducted as detailed in Section 6.2.3.1. Results are presented in Table 32. Full results of surface water toxicity tests are provided in Appendix D.

Neither survival nor the two growth endpoints (average dry biomass and average dry weight) were significantly affected in *Pimephales promelas* exposed to Grove Pond water. These results are not surprising given the general lack of exceedances of surface water benchmarks.

7.4.3 Measurement Endpoint C: Critical Body Residue (CBR) Evaluation

The third measurement endpoint for determining potential risk to fish was a comparison of fish tissue body burdens to literature CBRs for fish, as discussed in Section 6.2.2.3.

7.4.3.1 Grove Pond

Hazard quotients for Grove Pond fish are shown in Table 33 and 34. Table 33 presents a screening table comparing the maximum concentration of fish tissue over all species with NOAEL-based CBRs. This comparison was made to select chemicals for which species-specific HQs were calculated. Hazard quotients were calculated for both maximum and average EPCs and both NOAEL and LOAEL CBRs (Table 34).

As shown in Table 33, the maximum fish tissue concentration exceeded the NOAEL CBR for nine metals and two pesticides. Species-specific HQs were calculated for these chemicals.

Brown Bullhead

Hazard quotients based on maximum EPCs and NOAEL CBRs ($HQ_{Max\text{-}NOAEL}$) were greater than one for six metals and DDE. Hazard quotients based on average EPCs and NOAEL CBRs ($HQ_{Avg\text{-}NOAEL}$) were greater than one for five metals and DDE. Hazard quotients based on maximum EPCs and LOAEL CBRs ($HQ_{max\text{-}LOAEL}$) were greater than one for copper and lead only. Finally Hazard quotients based on average EPCs and LOAEL CBRs ($HQ_{Avg\text{-}LOAEL}$) were greater than one also for copper and lead only. None of the HQs exceeded 10, suggesting low-level risk to the brown bullhead.

Bluegill

The $HQ_{Max\text{-}NOAEL}$ were greater than one for four metals and two pesticides. The $HQ_{Avg\text{-}NOAEL}$ were greater than one for four metals and one pesticide. The $HQ_{max\text{-}LOAEL}$ and $HQ_{Avg\text{-}LOAEL}$ were greater than one also for copper and lead only. None of the HQs exceeded 10, suggesting low-level risk to the bluegill.

Large Mouth Bass

Hazard quotients based on maximum EPCs and NOAEL CBRs ($HQ_{Max\text{-}NOAEL}$) were greater than one for eight metals and two pesticides. Only cadmium (28) and lead (15) had HQs greater than 10. The $HQ_{Avg\text{-}NOAEL}$ were greater than one for four metals and two pesticides, with none greater than 10. The $HQ_{max\text{-}LOAEL}$ were greater than one for four metals with the HQ for lead (13) being the only HQ greater than 10. Finally, the $HQ_{Avg\text{-}LOAEL}$ were greater than one for copper and lead only, both of which were only slightly greater than one. The results suggest that largemouth bass are potentially at low-level risk from a few metals accumulated in tissue. Greater risk from copper and lead may be present for individuals with the highest concentrations of these metals in their tissue.

Yellow Bullhead

The $HQ_{Max\text{-}NOAEL}$ and $HQ_{Avg\text{-}NOAEL}$ were greater than one for four metals three metals and DDE, but all HQ were well below 10. The $HQ_{max\text{-}LOAEL}$ and $HQ_{Avg\text{-}LOAEL}$ were greater than one only for copper and lead only. None of the HQs exceeded 10, suggesting low-level risk to the yellow bullhead.

Black Crappie

Hazard quotients based on NOAEL CBRs (HQ_{NOAEL}) were greater than one for chromium, copper, and DDE. None were greater than 10. Hazard quotients based on LOAEL CBRs (HQ-

$_{LOAEL}$) were greater than one for chromium and copper only and both HQ were only slightly greater than one, suggesting low-level risk to the black crappie.

Pickerel

Hazard quotients based on NOAEL CBRs (HQ_{NOAEL}) were greater than one for copper, zinc, and DDE. None were greater than 10. Hazard quotients based on LOAEL CBRs (HQ_{-LOAEL}) were greater than one for copper and zinc only and both HQ were only slightly greater than one, suggesting low-level risk to the pickerel.

7.4.3.2 Plow Shop Pond

Hazard quotients for Plow Shop Pond fish are shown in Table 35 and 36. Table 35 presents a screening table comparing the maximum concentration of fish tissue over all species with NOAEL-based CBRs. This comparison was made to select chemicals for which species-specific HQs were calculated. Hazard quotients were calculated for both maximum and average EPCs and both NOAEL and LOAEL CBRs (Table 36).

As shown in Table 35, the maximum fish tissue concentration exceeded the NOAEL CBR for five metals and two pesticides. Species-specific HQs were calculated for these chemicals.

Large Mouth Bass

Hazard quotients based on maximum EPCs and NOAEL CBRs ($HQ_{Max-NOAEL}$) were greater than one for four metals and two pesticides. Only DDE (13) had an HQ greater than 10. The $HQ_{Avg-NOAEL}$ were greater than one for three metals and DDE, with none greater than 10. The $HQ_{max-LOAEL}$ were greater than one for copper and DDE only, both only slightly greater than one. Finally, the $HQ_{Avg-LOAEL}$ were greater than one for copper only, and it was also only slightly greater than one. The results suggest that largemouth bass are potentially at low-level risk from a few metals accumulated in tissue. Greater risk from exposure to DDE may be present for individuals with the highest concentrations in their tissue.

Bullhead

Hazard quotients based on maximum EPCs and NOAEL CBRs ($HQ_{Max-NOAEL}$) were greater than one for chromium, copper, and DDE, none of which were greater than 10. The $HQ_{Avg-NOAEL}$, $HQ_{max-LOAEL}$, and $HQ_{Avg-LOAEL}$ were greater than one also for copper only and none of the HQs exceeded 10, suggesting low-level risk to the bullhead.

Bluegill

The $HQ_{Max-NOAEL}$ were greater than one for three metals and DDE. All HQs were less than 10. The $HQ_{Avg-NOAEL}$ were greater than one for two metals and DDE, copper having the highest HQ of 2.2. The $HQ_{max-LOAEL}$ and $HQ_{Avg-LOAEL}$ were greater than one for copper only, 4.3 and 2.1, respectively. The results suggest only low-level risk from metals and DDE to the bluegill.

Black Crappie

The $HQ_{Max-NOAEL}$ were greater than one for chromium, copper, and DDE. The $HQ_{Avg-NOAEL}$ were greater than one for copper only. The $HQ_{max-LOAEL}$ were also greater than one for chromium, copper, and DDE and the $HQ_{Avg-LOAEL}$ were greater than for copper only. None of the HQs exceeded 10, suggesting low-level risk to the black crappie.

7.4.4 Fish Community Risk Characterization

The results for Grove Pond support the findings of a previous fish community survey conducted as part of the RI Addendum (ABB-ES 1993). Baseline information was collected on species, relative abundance of species, fish size distribution, and trophic structure of the fish community. A total of 193 fish were collected with 12 species in 7 families represented. The fish community was found to be typical of warm water fisheries in New England.

7.4.5 Fish Community Weight of Evidence Integration

The WOE Integration results for water column invertebrates are identical for Grove Pond and Plow Shop Pond, so they are merged in this section.

Assessment Endpoint:
Protect the long-term health of local fish populations

Measurement Endpoints:
A. Compare surface water contaminant concentrations against surface water benchmarks
B. Assess surface water toxicity using P. promelas
C. Compare measured fish tissue residue levels against fish CBRs

Weight-of-Evidence Integration

	Weight (from Table 8)				
Risk/Magnitude	Low	Low-Medium	Medium	Medium-High	High
Yes/High					
Yes/Medium					
Yes/Low		**A**		**C**	
Indeterminate					
No Risk			**B**		

Summary:

Three lines of evidence were used to assess the potential risk to the fish community in Grove and Plow Shop Ponds. Comparing measured surface water COPC concentrations to generic benchmarks identified a potential for low risk, but with a low-medium WOE; measuring surface water toxicity using larval stages of the fathead minnow did not identify the potential for risk; comparing measured tissue residue levels in several fish species captured from the two ponds identified a low potential for risk, with a medium-high WOE. Overall, the available data indicate that it is not likely that the fish communities in the two ponds will experience significant risk from Site-related COPCs.

A semi-quantitative fish community survey performed in Grove Pond in the early 1990s indicated the fish community was typical of that found in warm-water fisheries in New England. This information further supports the conclusion that the fish community in Grove Pond is not likely to be affected by exposure to Site-COPCs.

7.5 ASSESSMENT ENDPOINT 4: OMNIVOROUS MAMMAL POPULATIONS

The assessment endpoint was the protection of omnivorous mammals foraging in pond shallows, to insure that ingestion of chemicals in food items, sediment, and surface water does not have a negative impact on growth, survival, and reproduction. *Are the levels of contaminants in surface water and aquatic prey sufficiently high to impair omnivorous mammal populations foraging in Grove Pond and Plow Shop Pond?*

7.5.1 Grove Pond Raccoon

7.5.1.1 Measurement Endpoint: Hazard Quotients based on NOAEL and LOAEL TRVs

The measurement endpoint was a comparison of an estimated daily intake with a literature-derived TRV for mammals to calculate an HQ. Hazard quotients for the raccoon foraging in Grove Pond are shown in Table 37 (maximum EPCs) and Table 38 (average EPCs).

Hazard quotients for the raccoon based on maximum EPCs and NOAEL TRVs were greater than one for 14 metals and for total PAHs (Table 37). Hazard quotients were between one and 10 for barium, beryllium, cobalt, lead manganese, methylmercury, selenium, thallium and total PAHs. Hazard quotients were between 10 and 100 for antimony, cadmium, copper, and vanadium. The highest NOAEL-based HQ_{max} were for aluminum (1064) and arsenic (166).

Hazard quotients for the raccoon based on maximum EPCs and LOAEL TRVs were greater than one for eight metals and total PAHs. Hazard quotients were between one and 10 for antimony, barium, cadmium, selenium, vanadium, and total PAHs. Hazard quotients were between 10 and 100 for arsenic and copper. The highest LOAEL-based HQ_{max} was for aluminum (106).

Because it is unlikely that wildlife receptors forage only in areas with the highest COPC concentrations, HQs were also determined for exposures to average EPCs for site media. Hazard quotients for the raccoon based on average EPCs and NOAEL TRVs were greater than one for nine metals and for total PAHs (Table 38). Hazard quotients were between one and 10 for barium, manganese, methylmercury, selenium, thallium, and total PAHs. Hazard quotients were between 10 and 100 for antimony, arsenic, and vanadium. The highest NOAEL-based HQ_{Avg} was for aluminum (128).

Hazard quotients for the raccoon based on average EPCs and LOAEL TRVs were greater than one for four metals. Hazard quotients were between one and 10 for antimony, arsenic, and vanadium. The highest LOAEL-based HQ_{Avg} was for aluminum (13).

7.5.1.2 Modification of HQs Based on Different Prey Items

The raccoon is not likely to ingest all fish and invertebrate prey items equally. For example, the raccoon is more likely to feed on mussels and crayfish than odonate larvae and on small fish species than largemouth bass. Therefore, an evaluation of the possible influence of different EPC in different invertebrate and fish taxa on uptake in the raccoon was evaluated. This evaluation was based on an assessment of the dietary items contributing most to risk.

Because the daily intake of a given chemical may not be the same from all dietary sources, an evaluation of the major pathways was made in order to elucidate from where the risk may be originating for each chemical. This evaluation was conducted by dividing the daily uptake for each individual dietary component (e.g., invertebrates) by the total daily uptake. The results are summarized in Table 39 (max EPCs) and Table 40 (average exposures). The worksheets used to derive the percentages of risk attributed to each dietary item are provided in Appendix E. These results are discussed on a chemical specific basis below.

7.5.1.2.1 Modification of HQs Based on Different Invertebrate Taxa

Maximum EPC

For the raccoon, HQs based on maximum exposures exceeded one for 14 metals and PAH total. Of these chemicals, the invertebrate ingestion pathway was a significant risk driver for antimony, beryllium, cobalt, manganese, thallium, vanadium, and PAH (Table 39). The invertebrate EPC for barium, manganese, and selenium only were based on biological tissue analyses; the EPCs for the other chemicals were based on the sediment concentration and the BSAF and are not taxa-specific. For the three metals for which there were biological tissue data, the data were only for crayfish; the metals were not analyzed in odonata tissue. Therefore, the risk estimates would not change if they were adjusted to account for variations in concentrations between invertebrate taxa.

Average EPC

For the raccoon, HQs based on average exposures exceeded one for nine metals and PAH total. Of these chemicals, the invertebrate ingestion pathway was a significant risk driver for antimony, barium, manganese, thallium, vanadium, and PAH. The invertebrate EPC for barium, manganese, and selenium only were based on biological tissue analyses; the EPCs for the other chemicals were based on the sediment concentration and the BSAF and are not taxa-specific. For the three metals for which there were biological tissue data, the data were only for crayfish; the metals were not analyzed in odonata tissue. Therefore, the risk estimates would not change if they were adjusted to account for variations in concentrations between invertebrate taxa.

7.5.1.2.2 Modification of HQs Based on Different Fish Species

Maximum EPC

For the raccoon, HQs based on maximum exposures exceeded one for 14 metals and PAH total. Of these chemicals, the fish ingestion pathway was a significant risk driver only for methylmercury. The NOAEL HQ for methylmercury was only slightly greater than one and the LOAEL HQ was below one. A species-specific adjustment of the fish EPC, therefore, would not change the risk picture significantly.

Average EPC

For the raccoon, HQs based on average exposures exceeded one for nine metals and PAH total. Of these chemicals, the fish ingestion pathway was a significant risk driver only for methylmercury, with 22% of total risk coming from ingestion of fish. The NOAEL and LOAEL HQs are both low, however, and a species-specific adjustment of the fish EPC would not change the risk picture significantly.

7.5.1.3 Residual Risk Evaluation for the Grove Pond Raccoon

The RR derivation is presented in Appendix G and summarized in Table 41 (maximum EPC) and Table 42 (average EPC). The RR for maximum exposures (Table 41) were greater than one for all COPC, suggesting that risk from maximum exposures cannot be attributed to background conditions. The RR for average exposures (Table 42), on the other hand, were less than one for arsenic, barium, methylmercury and total PAHs, and barely greater than one for manganese and vanadium. This suggests that the majority of risk from these chemicals to the raccoon foraging throughout Grove Pond is due to background conditions.

7.5.1.4 Chemical-Specific Risk Characterization for the Grove Pond Raccoon

The chemicals that present potential unacceptable risk for the raccoon are those with elevated HQs based on average exposures. For raccoons foraging in Grove Pond, the following chemicals merit the most concern based on HQs:

Aluminum
Average exposure NOAEL-based and LOAEL-based HQs for aluminum are very high (128 and 12.8, respectively) (Table 38). These HQs may not equate to unacceptable risk for the raccoon, however, for a couple reasons. First of all, 98% of risk to the raccoon, based on average exposures, is from incidental ingestion of sediment. It is likely that most of that Al is not bioavailable because it is bound up in the sediment matrix. Hence, the likelihood for this potential risk to be realized is low, though the uncertainty surrounding this risk estimate is high.

Antimony

Hazard quotients suggest that antimony poses potential risk to the raccoon, with NOAEL-based and LOAEL-based HQs of 14 and 1.4, respectively (Table 38). Antimony was only detected in 2 of 120 sediment samples analyzed, however. Dietary items other than plants, including incidental ingestion of sediment, are all significant sources of antimony in the raccoon food chain model. This is because all EPCs are modeled from the sediment EPC. In most samples in Grove Pond, sediment concentrations were ND, and modeled dietary concentrations would be ND as well.

Another factor that plays a role in the elevated HQs for antimony is that the BSAF for antimony is a default value of 0.9, from EPA (1999b). This BSAF may overestimate bioaccumulation in aquatic biota. Antimony is not known to be highly bioaccumulative and HAZWRAP (1994) lists a soil-invert bioaccumulation factor (BAF) of 0.5. Further, antimony was not detected in fish tissue samples in Grove Pond.

Given the very low frequency of detection and the uncertainty associated with the BSAF for antimony, the high HQs do not equate to unacceptable risk for the raccoon.

Arsenic

Arsenic had HQs that suggest risk to the raccoon, with NOAEL-based and LOAEL-based HQs of 15 and 1.5, respectively (Table 38). Arsenic was not detected at high concentrations in dietary items of the raccoon. The primary route of exposure, therefore, is via direct ingestion of arsenic in sediment. A back calculation shows that any sediment concentration greater than 50 mg/kg would yield a LOAEL-based HQ greater than one. Concentrations greater than this were found throughout the pond. The RR for arsenic to the Grove Pond raccoon is less than one for average exposures, however. This suggests that risk to the raccoon foraging throughout Grove Pond might be attributable to background conditions.

Vanadium

Vanadium had HQs that suggest risk to the raccoon, with NOAEL-based and LOAEL-based HQs of 20 and 2, respectively (Table 38). Vanadium was not detected at high concentrations in fish or frogs, but invertebrate and egg tissue concentrations were high because they were modeled directly from sediment concentrations using a BSAF of 1.0. A back calculation shows that any sediment concentration great than 16 mg/kg would yield a LOAEL-based HQ greater than one. Concentrations greater than this were found throughout the pond.

Vanadium concentrations in Grove Pond sediment may not pose unacceptable risk because risk may be overestimated. As noted previously, concentrations in invertebrates and eggs are modeled directly from vanadium concentrations using a conservative estimate of 1.0. This BSAF is probably overestimated, as measured concentrations in fish tissue and frog tissue are low, indicting that vanadium is not very bioaccumulative. In addition, HAZWRAP (1994) reports a soil-invertebrate BAF of 0.13, further suggesting that vanadium is not likely to bioaccumulate following the above assumption (BSAF=1).

The RR for vanadium to Grove Pond raccoon is greater than one, but only slight greater than one (1.1). This suggests that the majority of risk from vanadium to the raccoon foraging throughout Grove Pond is attributable to background conditions.

Because the BSAF is probably unrealistically high and because the RR for vanadium is only slightly greater than one, vanadium does not likely present unacceptable risk to the raccoon.

Other Chemicals

Barium, manganese, methylmercury, selenium, thallium, and Total PAHs all had HQs based on average EPCs and NOAEL TRVs greater than one. All of these HQ were low, however, with that for thallium (3.4) being the highest. Further, none of the HQs based on LOAEL TRVs exceeded one. Therefore, risk to the raccoon from these COPC is considered minimal.

7.5.1.5 Summary

While maximum HQs are very high for some chemicals, the raccoon probably does not forage only in areas with maximum COPC. For the raccoon foraging throughout Grove Pond, a few COPC present potential risk based on $HQ_{average}$. Because risk from most of these COPC can be attributed in large part to background conditions, the site related risk to the raccoon in Grove Pond is considered low.

7.5.1.6 Weight of Evidence Integration - Grove Pond

Assessment Endpoint:
Protect the long-term health of local omnivorous mammal populations (raccoon)

Measurement Endpoints:

A. Compare calculated total daily doses against target receptor TRVs

Weight-of-Evidence Integration

	Weight (from Table 8)				
Risk/MAGNITUDE	Low	Low-Medium	Medium	Medium-High	High
Yes/High					
Yes/Medium					
Yes/Low					
Indeterminate					
No Risk				**A**	

Summary:

One line of evidence was used to assess the potential risk to omnivorous mammals, represented by the raccoon, foraging in Grove Pond. Comparing COPC-specific TDDs derived from food chain modeling to COPC-specific TRVs derived from the literature was given a medium-high weight. This approach identified risk (average HQ_{LOAEL} >1.0) for aluminum, antimony, arsenic, and vanadium. However, the residual risk calculations indicate that most of this risk was also present at the background location. Overall, the available evidence indicates that it is not likely that omnivorous mammals are at significant risk when foraging in Grove Pond.

7.5.2 Plow Shop Pond Raccoon

7.5.2.1 Measurement Endpoint: Hazard Quotients based on NOAEL and LOAEL TRVs

The measurement endpoint was a comparison of an estimated daily intake with a literature-derived TRV for mammals to calculate an HQ. Both NOAEL and LOAEL TRVs were used to obtain a range of risk values for each COPC. However, the potential for unacceptable risk was assumed to be present only if the average HQ_{LOAEL} exceeded 1.0. Hazard quotients for the raccoon foraging in Plow Shop Pond are shown in table 43 (maximum EPCs) and Table 44 (average EPCs).

Hazard quotients for the raccoon based on maximum EPCs and NOAEL TRVs were greater than one for 13 metals and total PAHs (Table 43). Hazard quotients were between one and 10 for barium, cadmium, cobalt, copper, lead, methylmercury, and selenium. Hazard quotients were between 10 and 100 for antimony, manganese, and total PAHs. The highest NOAEL-based HQ_{max} were for aluminum (327), arsenic (1234), thallium (632) and vanadium (101).

Hazard quotients for the raccoon based on maximum EPCs and LOAEL TRVs were greater than one for ten metals and total PAHs (Table 43). Hazard quotients were between one and 10 for antimony, barium, copper, manganese, methylmercury, selenium and total PAHs. Hazard quotients were between 10 and 100 for aluminum, thallium, and vanadium. The highest LOAEL-based HQ_{Max} was for arsenic (123).

Because it is unlikely that wildlife receptors forage only in areas with the highest COPC concentrations, HQs were also determined for exposures to average EPCs in site media. Hazard quotients for the raccoon based on average EPCs and NOAEL TRVs were greater than one for nine metals and total PAHs (Table 44). Hazard quotients were between one and 10 for barium, manganese, methylmercury, selenium, and total PAHs. Hazard quotients were between 10 and

100 for aluminum (99), antimony, and vanadium. The highest NOAEL-based HQ_{Avg} were for arsenic (100) and thallium (501).

Hazard quotients for the raccoon based on average EPCs and LOAEL TRVs were greater than one for six metals (Table 34). Hazard quotients were between one and 10 for aluminum (9.9), antimony, vanadium, and selenium. The highest LOAEL-based HQ_{Avg} were for arsenic (10) and thallium (50).

7.5.2.2 Modification of HQs Based on Different Prey Items

The raccoon is not likely to ingest all fish and invertebrate prey items equally. For example, the raccoon is more likely to feed on mussels and crayfish than odonate larvae and on small fish species than largemouth bass. Therefore, an evaluation of the possible influence of different EPC in different invertebrate and fish taxa on uptake in the raccoon was evaluated. This evaluation was based on an assessment of the dietary items contributing most to risk.

Because the daily intake of a given chemical may not be the same from all dietary sources, an evaluation of the major pathways was made in order to elucidate from where the risk may be originating for each chemical. This evaluation was conducted by dividing the daily uptake for each individual dietary component (e.g., invertebrates) by the total daily uptake. The results are summarized in Table 39 (max EPCs) and Table 40 (average exposures). The worksheets used to derive the percentages of risk attributed to each dietary item are provided in Appendix E. These results are discussed on a chemical specific basis below.

7.5.2.2.1 Modification of HQs Based on Different Invertebrate Taxa

Maximum EPC

For the raccoon in Plow Shop Pond, HQs based on maximum exposures exceeded one for 13 metals and PAH total. Of these chemicals, the invertebrate ingestion pathway was a significant risk driver for antimony, barium, cobalt, thallium, vanadium, and PAH (Table 39). The invertebrate EPC for barium only was based on biological tissue analyses; the EPCs for the other chemicals were based on the sediment concentration and the BSAF. For barium, the NOAEL HQ was were only slightly greater than one and the LOAEL HQs were less than one; therefore, an adjustment of the invertebrate EPCs based on the taxonomic group would not change the risk picture significantly.

Average EPC

For the raccoon, HQs based on average exposures exceeded one for nine metals and PAH total. Of these chemicals, the invertebrate ingestion pathway was a significant risk driver for antimony, barium, manganese, thallium, vanadium, and PAH (Table 40). The invertebrate EPC for barium and manganese only were based on biological tissue analyses; the EPCs for the other chemicals were based on the sediment concentration and the BSAF. For both of these metals, the NOAEL HQs were only slightly greater than one and the LOAEL HQs were less than one; therefore, an adjustment of the invertebrate EPCs based on the taxonomic group would not change the risk picture significantly.

7.5.2.2.2 Modification of HQs Based on Different Fish Species

Maximum EPC

For the raccoon, HQs based on maximum exposures exceeded one for 13 metals and PAH total. Of these chemicals, the fish ingestion pathway was a significant risk driver only for methylmercury (Table 39). An uptake adjustment was made based on the different concentrations of methylmercury between fish species ingested by the raccoon (Table F-1). For methylmercury, the highest HQs were those based on ingestion of largemouth bass. Hazard quotients based on bullhead, bluegill, and crappie were lower, with no LOAEL-based HQ greater than one. The raccoon may be more likely to feed the three smaller species than on largemouth bass and the HQs for the raccoon based on ingestion of the smaller fish are probably more reflective of actual site risk in Plow Shop Pond. The NOAEL-based HQs for mercury based on the smaller species were all approximately 3, for each species. The LOAEL-based HQs were all less than one.

Average EPC

For the raccoon, HQs based on average exposures exceeded one for nine metals and PAH total. Of these chemicals, the fish ingestion pathway was a significant component of risk for methylmercury only (Table 40). The NOAEL HQ was only slightly greater than one and the LOAEL HQ was less than one; therefore, a species-specific adjustment of the fish EPC would not change the risk picture significantly.

7.5.2.3 Residual Risk Evaluation for the Plow Shop Pond Raccoon

The RR derivation is presented in Appendix G and summarized in Table 41 (maximum EPC) and Table 42 (average EPC). For the raccoon in Plow Shop Pond, the RR for maximum exposures (Table 41) were greater than one for all COPC, suggesting that risk from maximum exposures cannot be attributed to background conditions. The RR for average exposures (Table 42), on the other hand, were less than one for cadmium, methylmercury, vanadium, and total PAHs, and barely greater than one for aluminum, beryllium, cobalt, and lead. This suggests that the majority of risk from these chemicals to the raccoon foraging throughout Plow Shop Pond is due to background conditions.

7.5.2.4 Chemical-Specific Risk Characterization for the Plow Shop Pond Raccoon

The chemicals that present potential unacceptable risk for the raccoon are those with elevated HQs based on average exposures. For raccoons foraging in Plow Shop Pond, the following chemicals merit the most concern based on HQs:

Aluminum

Average exposure NOAEL-based and LOAEL-based HQs for aluminum are very high (99 and 10, respectively). These HQs may not equate to unacceptable risk for the raccoon, however, for a couple reasons. First of all, 98% of risk to the raccoon, based on average exposures, is from incidental ingestion of sediment. It is likely that most of that Al is not bioavailable because it is bound up in the sediment matrix. Hence, the likelihood for this potential risk to be realized is low, though the uncertainty surrounding this risk estimate is high. Because of the likelihood that aluminum in sediment is not bioavailable and because of the low RR (1.2), aluminum probably does not pose unacceptable site-related risk to the raccoon foraging throughout Plow Shop Pond.

Antimony

Antimony was only detected in 5 of 63 sediment samples in Plow Shop Pond, four of which were located adjacent to the Railroad Roundhouse, suggesting an antimony source in this area. The pond average concentration (15 mg/kg) seems to be driven by a few samples with high detection limits. Of the samples with ND values, most had detection limits less than ten but a small number of samples had detection limits much greater. The few samples with high detection limits have a disproportionate effect on the site average concentration.

Dietary items other than plants, including incidental ingestion of sediment, are all significant sources of antimony in the raccoon food chain model. This is because all EPCs are modeled from the sediment EPC. In most samples in Plow Shop Pond, sediment concentrations are low or ND, and modeled dietary concentrations would be low or ND as well.

Another factor that plays a role in the HQ calculation for antimony is that the BSAF for antimony is a default value of 0.9, from EPA (1999b). This BSAF may overestimate bioaccumulation in aquatic biota. Antimony is not known to be highly bioaccumulative and HAZWRAP (1994) lists a soil-invert bioaccumulation factor (BAF) of 0.5. Further, antimony was not detected in fish tissue samples in Plow Shop Pond.

Given the limited aerial extent of antimony detections, the elevated detections limits in ND samples, and the uncertainty associated with the BSAF for antimony, the high HQs do not necessarily equate to unacceptable risk for the raccoon.

Arsenic

Arsenic had HQs that suggest risk to the raccoon, with NOAEL-based and LOAEL-based HQs of 100 and 10, respectively (Table 38). Arsenic was not detected at high concentrations in dietary items of the raccoon. The primary route of exposure, therefore, is via direct ingestion of arsenic in sediment. A back calculation shows that any sediment concentration greater than 50 mg/kg would yield a LOAEL-based HQ greater than one. Concentrations greater than this were found throughout the pond, suggesting unacceptable risk to the raccoon. The RR for arsenic to the Plow Shop raccoon is 59, suggesting that the majority of the risk is due to arsenic levels in Plow Shop Pond.

Selenium

The NOAEL and LOAEL-based HQs for selenium suggest risk for the raccoon. Exposure point concentrations for dietary items were low and the primary route of uptake of selenium is via incidental ingestion of sediment. Selenium was detected in 30 of 110 Plow Shop Pond samples. The site average was 14 mg/kg. The average of detected samples only was 4 mg/kg. Elevated detection limits, therefore, drive the site average higher than should be expected. NOAEL and LOAEL-based HQs based on a concentration of 4 mg/kg, the average concentration of detected values, would be less than one. Selenium in Plow Shop Pond sediments, therefore, does not pose unacceptable risk for the raccoon.

Thallium

The highest HQs for the raccoon in Plow Shop Pond were for thallium. Risk from exposure to thallium is based directly on sediment concentrations because food items were modeled using a default BSAF of 0.9 from EPA (1999b). This BSAF is thought to be overly conservative. Thallium was not detected in any of the 20 fish samples collected in Plow Shop Pond.

Thallium was only detected in three of 48 samples in Plow Shop Pond, all from one sampling effort, the 1998 samples labeled PSEM-1 through PSEM-3. The site EPC were based on these samples only, as inclusion of ND values would have resulted in an unrealistically high average based on ½ DL values. Given the low frequency of detection and the likely overestimation of bioaccumulation for thallium, the elevated HQs for thallium may not equate to unacceptable risk.

Vanadium

Uptake of vanadium by the raccoon is primarily through ingestion of invertebrates, eggs, and sediment. The invertebrate and egg EPCs are directly effect by the sediment vanadium concentration because they were modeled using a default BSAF of one. While no BSAF was found specifically for vanadium, the metal is not thought to be highly bioaccumulative. This is evidenced by the low average concentrations detected in frog tissue (0.33 mg/kg) and fish tissue (0.6 mg/kg) compared to the modeled concentration in other biota (27 mg/kg). In addition, HAZWRAP (1994) reports a soil-invertebrate BAF of 0.13, further suggesting that vanadium is not likely to bioaccumulate following the above assumption (BSAF=1). The BSAF for vanadium, therefore, probably overestimates risk to the raccoon that may be elevated even at background concentrations.

The average RR for vanadium to Plow Shop Pond raccoon is less than one. This suggests that the majority of risk from vanadium to the raccoon foraging throughout Plow Shop Pond is attributable to background conditions.

Because the BSAF is probably unrealistically high. Further, because the average RR for vanadium is below one, vanadium does not likely present unacceptable risk to the raccoon.

Other Chemicals

Barium, manganese, methylmercury, and total PAHs all had HQs based on average EPCs and NOAEL TRVs greater than one. All of these HQ were low, however, with that for total PAH (2.1) being the highest. Further, none of the HQs based on LOAEL TRVs exceeded one. Therefore, risk to the raccoon from these COPC is considered minimal.

7.5.2.5 Summary

While maximum HQs are very high for some chemicals, the raccoon probably does not forage only in areas with maximum COPC. For the raccoon foraging throughout Plow Shop Pond, a few COPC present potential risk based on $HQ_{average}$. Risk from most of these COPC can be attributed in large part to background conditions or be explained by an unrealistically high bioaccumulation assumption. Arsenic, however, does pose potential unacceptable risk to the raccoon and the high HQs cannot be attributed to background. The overall risk to the raccoon in Plow Shop Pond is considered high because of arsenic. There is significant uncertainty associated with this conclusion, however, because risk is based on incidental ingestion of sediment. The uncertainty associated with the estimated sediment ingestion rate is discussed in Section 7.10.

7.5.2.6 Weight of Evidence Integration - Plow Shop Pond

Assessment Endpoint:
Protect the long-term health of local omnivorous mammal populations (raccoon)

Measurement Endpoints:
A. Compare calculated total daily doses against target receptor TRVs

Weight-of-Evidence Integration

	Weight (from Table 8)				
Risk/MAGNITUDE	Low	Low-Medium	Medium	Medium-High	High
Yes/High				**A**	
Yes/Medium					
Yes/Low					
Indeterminate					
No Risk					

Summary:

One line of evidence was used to assess the potential risk to omnivorous mammals, represented by the raccoon foraging in Plow Shop Pond. Comparing COPC-specific TDDs derived from food chain modeling to COPC-specific TRVs derived from the literature was given a medium-high weight. This approach identified risk (average HQ_{LOAEL} >1.0) for aluminum, antimony, arsenic, selenium, thallium and vanadium. However, the residual risk calculations indicate that most of the risk from aluminum and vanadium is also present at the background location. The risk from antimony, selenium, and thallium results from conservative bioaccumulation factors, high analytical detection limits, or low detection frequencies. The high risk from arsenic appears to be site-specific and associated almost exclusively with sediment ingestion. Overall, the available evidence indicates that there is the potential for significant risk from arsenic to omnivorous mammals foraging in Plow Shop Pond. .

7.6 ASSESSMENT ENDPOINT 5: PISCIVOROUS MAMMAL POPULATIONS

The assessment endpoint was protection of piscivorous mammals foraging in the pond, to insure that ingestion of chemicals in food items, sediment, and surface water does not have a negative impact on growth, survival, and reproduction. *Are the levels of contaminants in surface water and aquatic prey sufficiently high to impair piscivorous mammal populations foraging in Grove Pond and Plow Shop Pond?*

7.6.1 Grove Pond Mink

7.6.1.1 Measurement Endpoint: Hazard Quotients based on NOAEL and LOAEL TRVs

The measurement endpoint was a comparison of an estimated daily intake with a literature-derived TRV for mammals to calculate an HQ. Both NOAEL and LOAEL TRVs were used to obtain a range of risk values for each COPC. However, the potential for unacceptable risk was assumed to be present only if the average HQ_{LOAEL} exceeded 1.0. Hazard quotients for the mink foraging in Grove Pond are shown in table 45 (maximum EPCs) and Table 46 (average EPCs).

Hazard quotients for the mink based on maximum EPCs and NOAEL TRVs were greater than one for six metals (Table 45). Hazard quotients were between one and 10 for cadmium, copper, methylmercury, and vanadium. Hazard quotients were between 10 and 100 for aluminum and arsenic.

Hazard quotients for the mink based on maximum EPCs and LOAEL TRVs were greater than one for three metals: aluminum, arsenic, and copper (Table 45). None of the LOAEL-based HQ_{Max} exceeded 10.

Because it is unlikely that wildlife receptors forage only in areas with the highest COPC concentrations, HQs were also determined for exposures to average EPCs for site media. Hazard quotients for the mink based on average EPCs and NOAEL TRVs were greater than one for aluminum and arsenic only (Table 46). Both NOAEL-based $HQ_{average}$ were less than 10.

No HQs based on average EPCs and LOAEL TRVs were greater than one (Table 46).

7.6.1.2 Modification of HQs Based on Different Prey Items

The mink is not likely to ingest all fish species equally. For example, the mink is more likely to feed on small fish species than largemouth bass. Therefore, an evaluation of the possible influence of different EPC in different fish taxa on uptake in the mink was evaluated. This evaluation was based on an assessment of the dietary items contributing most to risk.

Because the daily intake of a given chemical may not be the same from all dietary sources, an evaluation of the major pathways was made in order to elucidate from where the risk may be originating for each chemical. This evaluation was conducted by dividing the daily uptake for each individual dietary component (e.g., invertebrates) by the total daily uptake. The results are summarized in Table 39 (max EPCs) and Table 40 (average exposures). The worksheets used to derive the percentages of risk attributed to each dietary item are provided in Appendix E. These results are discussed on a chemical specific basis below.

7.6.1.2.1 Modification of HQs Based on Different Fish Species

Maximum EPC

For the mink, NOAEL HQs based on maximum exposures exceeded one for six metals. Of these chemicals, the fish ingestion pathway was a significant risk component for methylmercury and vanadium. For both of these metals, the NOAEL-based HQ was only slightly greater than one and the LOAEL-based HQ was less than one. Adjusting the fish EPCs, therefore, to account for variations in concentrations between species would not change the risk picture significantly.

Average EPC

For the mink, NOAEL HQs based on average exposures exceeded one for two metals. Of these chemicals, the fish ingestion pathway was a significant risk factor for arsenic only. Because the NOAEL-based HQ barely exceeds one, adjusting the fish EPC to account for variations in concentrations between species would not change the risk picture significantly.

7.6.1.3 Residual Risk Evaluation for the Grove Pond Mink

The RR derivation is presented in Appendix G and summarized in Table 41 (maximum EPC) and Table 42 (average EPC). The Grove Pond RR for maximum exposures (Table 41) for the mink were greater than one for all COPC, suggesting that risk from maximum exposures cannot be attributed to background conditions. The RR for average exposures (Table 42), on the other hand, were less than one for manganese and barely greater than one for arsenic and methylmercury. This suggests that the majority of risk from these chemicals to the mink foraging throughout Grove Pond is due to background conditions.

7.6.1.4 Chemical-Specific Risk Characterization for the Grove Pond Mink

The chemicals that present potential unacceptable risk for the mink are those with elevated HQs based on average exposures. For mink foraging in Grove Pond, only aluminum and arsenic had HQs based on average EPCs and NOAEL TRVs greater than one. Both of these were low and neither chemical had a LOAEL TRV greater than one.

7.6.1.5 Summary

These low HQs for aluminum and arsenic probably do not equate to unacceptable risk for the mink in Grove Pond. Given the likelihood that the form of aluminum in sediment is not toxic to wildlife, as discussed in Section 7.5.1.4, and the low RR for arsenic, risk to the mink foraging in Grove Pond is considered low.

7.6.1.6 Weight of Evidence Integration - Grove Pond

Assessment Endpoint:
Protect the long-term health of local piscivorous mammal populations (represented by the mink)

Measurement Endpoints:
A. Compare calculated total daily doses against target receptor TRVs

Weight-of-Evidence Integration

	Weight (from Table 8)				
Risk/MAGNITUDE	Low	Low-Medium	Medium	Medium-High	High
Yes/High					
Yes/Medium					
Yes/Low					
Indeterminate					
No Risk				**A**	

Summary:

One line of evidence was used to assess the potential risk to piscivorous mammals, represented by the mink foraging in Grove Pond. Comparing COPC-specific TDDs derived from food chain modeling to COPC-specific TRVs derived from the literature was given a medium-high weight. This approach identified no risk (average HQ_{LOAEL} < 1.0) for any of the COPCs. Overall, the available evidence indicates that there is no significant risk to piscivorous mammals foraging in Grove Pond. .

7.6.2 Plow Shop Pond Mink

7.6.2.1 Measurement Endpoint: Hazard Quotients based on NOAEL and LOAEL TRVs

The measurement endpoint was a comparison of an estimated daily intake with a literature-derived TRV for mammals to calculate an HQ. Both NOAEL and LOAEL TRVs were used to obtain a range of risk values for each COPC. However, the potential for unacceptable risk was assumed to be present only if the average HQ_{LOAEL} exceeded 1.0. Hazard quotients for the mink foraging in Plow Shop Pond are shown in Table 47 (maximum EPCs) and Table 48 (average EPCs).

Hazard quotients for the mink based on maximum EPCs and NOAEL TRVs were greater than one for six metals (Table 47). Hazard quotients were between one and 10 for manganese, thallium, and vanadium. Hazard quotients were between 10 and 100 for aluminum and methylmercury. The highest NOAEL-based HQ_{Max} was for arsenic (77).

Hazard quotients for the mink based on maximum EPCs and LOAEL TRVs were greater than one for aluminum, arsenic, and methylmercury (Table 47). None of the LOAEL-based HQ_{max} were greater than 10.

Because it is unlikely that wildlife receptors forage only in areas with the highest COPC concentrations, HQs were also determined for exposures to average EPCs for site media. Hazard quotients for the mink based on average EPCs and NOAEL TRVs were greater than one for four metals: aluminum, arsenic, methylmercury, and thallium (Table 48). Arsenic (6.4) had the highest NOAEL-based $HQ_{average}$ but was still less than 10.

None of the HQs based on average EPCs and LOAEL TRVs were greater than one for the mink (Table 48).

7.6.2.2 Modification of HQs Based on Different Prey Items

The mink is not likely to ingest all fish species equally. For example, the mink is more likely to feed on small fish species than largemouth bass. Therefore, an evaluation of the possible influence of different EPC in different fish taxa on uptake in the mink was evaluated. This evaluation was based on an assessment of the dietary items contributing most to risk.

Because the daily intake of a given chemical may not be the same from all dietary sources, an evaluation of the major pathways was made in order to elucidate from where the risk may be originating for each chemical. This evaluation was conducted by dividing the daily uptake for each individual dietary component (e.g., invertebrates) by the total daily uptake. The results are summarized in Table 39 (max EPCs) and Table 40 (average exposures). The worksheets used to derive the percentages of risk attributed to each dietary item are provided in Appendix E. These results are discussed on a chemical specific basis below.

7.6.2.2.1 Modification of HQs Based on Different Fish Species

<u>Maximum EPC</u>

For the mink, NOAEL HQs based on maximum exposures exceeded one for six metals. Of these chemicals, the fish ingestion pathway was a significant risk factor for methylmercury and vanadium (Table 39). Because the NOAEL-based HQs only slightly exceeded one and the LOAEL-based HQs were less than one for vanadium, adjusting the fish EPC to account for variations in concentrations between species would not change the risk picture significantly for this metal. An uptake adjustment was conducted, however, for different concentrations of methylmercury between fish species ingested by the mink (Table F-2). For methylmercury, the highest HQs were those based on ingestion of largemouth bass. Hazard quotients based on bullhead, bluegill and crappie were lower, with no LOAEL-based HQs greater than one, while the LOAEL HQ for ingestion of largemouth bass was 2.2. The mink probably feeds more on the three smaller species than on largemouth bass and the HQs for the mink based on ingestion of the smaller fish are probably more reflective of actual site risk in Plow Shop Pond.

Average EPC

For the mink, NOAEL HQs based on average exposures exceeded one for four metals. Of these chemicals, the fish ingestion pathway was a significant risk factor for methylmercury only (Table 40). Because the methylmercury NOAEL-based HQ barely exceeds one and the LOAEL-based HQ is less than one, adjusting the fish EPC to account for variations in concentrations between species would not change the risk picture significantly for methylmercury.

7.6.2.3 Residual Risk Evaluation for the Plow Shop Pond Mink

The RR derivation is presented in Appendix G and summarized in Table 41 (maximum EPC) and Table 42 (average EPC). For the mink in Plow Shop Pond, the RR for maximum exposures (Table 41) were greater than one for all COPC, suggesting that risk from maximum exposures cannot be attributed to background conditions. The RR for average exposures (Table 42) were also greater than one for all COPC, although the RR for aluminum is barely greater than one. This suggests that the majority of risk from aluminum to the mink foraging throughout Plow Shop Pond is due to background conditions.

7.6.2.4 Chemical-Specific Risk Characterization for the Plow Shop Pond Mink

The chemicals that present potential unacceptable risk for the mink are those with elevated HQs based on average exposures. For mink foraging in Plow Shop Pond aluminum, arsenic, methylmercury, and thallium had HQs based on average EPCs and NOAEL TRVs greater than one. All of these HQ were low, however, with that for arsenic (6.4) being the highest. Further, none of the HQs based on LOAEL TRVs exceeded one. Given the low HQs, the likelihood that the form of aluminum in sediment is non-toxic to wildlife, and the likelihood that the HQ for mercury would be lower if based on small fish species likely to make up the mink's diet, risk to the raccoon from these COPC is considered minimal.

7.6.2.5 Summary

While maximum HQs were high for some chemicals, the mink probably does not forage only in areas with maximum COPC. For the mink foraging throughout Plow Shop Pond, a few COPC present potential risk based on $HQ_{average}$. Risk from aluminum, arsenic, methylmercury, and thallium is minimal. The overall risk to the mink foraging throughout Plow Shop Pond is considered low.

7.6.2.6 Weight of Evidence Integration - Plow Shop Pond

Assessment Endpoint:
Protect the long-term health of local piscivorous mammal populations (represented by the mink).

Measurement Endpoints:
A. Compare calculated total daily doses against target receptor TRVs.

Weight-of-Evidence Integration

	Weight (from Table 8)				
Risk/MAGNITUDE	Low	Low-Medium	Medium	Medium-High	High
Yes/High					
Yes/Medium					
Yes/Low					
Indeterminate					
No Risk				**A**	

Summary:

One line of evidence was used to assess the potential risk to piscivorous mammals, represented by the mink foraging in Plow Shop Pond. Comparing COPC-specific TDDs derived from food chain modeling to COPC-specific TRVs derived from the literature was given a medium-high weight. This approach identified no risk (average $HQ_{LOAEL} < 1.0$) for any of the COPCs. Overall, the available evidence indicates that there is no significant risk to piscivorous mammals foraging in Plow Shop Pond.

7.7 ASSESSMENT ENDPOINT 6: CARNIVOROUS BIRD POPULATIONS

The assessment endpoint was the protection of carnivorous birds foraging in pond shallows, to insure that ingestion of chemicals in food items, sediment, and surface water does not have a negative impact on growth, survival, and reproduction. *Are the levels of contaminants in surface water and aquatic prey sufficiently high to impair carnivorous bird populations foraging in Grove Pond and Plow Shop Pond?*

7.7.1 Grove Pond Black-Crowned Nigh Heron

7.7.1.1 Measurement Endpoint: Hazard Quotients based on NOAEL and LOAEL TRVs

The measurement endpoint was a comparison of an estimated daily intake with a literature-derived TRV for birds to calculate an HQ. Both NOAEL and LOAEL TRVs were used to obtain a range of risk values for each COPC. However, the potential for unacceptable risk was assumed to be present only if the average HQ_{LOAEL} exceeded 1.0. Hazard quotients for the black-crowned night heron foraging in Grove Pond are shown in Table 49 (maximum EPCs) and Table 50 (average EPCs).

Hazard quotients for the black-crowned night heron based on maximum EPCs and NOAEL TRVs were greater than one for 12 metals and three pesticides (Table 49). Hazard quotients were between one and 10 for aluminum, beryllium, cadmium, cobalt, copper, lead, inorganic mercury, thallium, and vanadium. Hazard quotients were between 10 and 100 for antimony, methylmercury, DDD, DDE, and DDT. The highest NOAEL-based HQ_{Max} was for chromium (278).

Hazard quotients for the black-crowned night heron based on maximum EPCs and LOAEL TRVs were greater than one for six metals and three pesticides (Table 49). Hazard quotients were between one and 10 for aluminum, antimony, copper, inorganic mercury, methylmercury, DDD, DDE, and DDT. The highest LOAEL-based HQ_{Max} was for chromium (56).

Because it is unlikely that wildlife receptors forage only in areas with the highest COPC concentrations, HQs were also determined for exposures to average EPCs for site media. Hazard quotients for the black-crowned night heron based on average EPCs and NOAEL TRVs were greater than one for five metals and three pesticides (Table 50). Hazard quotients were between one and 10 for lead, methylmercury, thallium, and the pesticides. Hazard quotients were greater than 10 for antimony (14) and chromium (31).

Hazard quotients for the black-crowned night heron based on average EPCs and LOAEL TRVs were greater than one for two metals only (Table 50). These were antimony (1.4) and chromium (6.3).

7.7.1.2 Modification of HQs Based on Different Prey Items

The black-crowned night heron is not likely to ingest all fish and invertebrate prey items equally. For example, the heron is more likely to feed on crayfish than odonate larvae and on small fish species than largemouth bass. Therefore, an evaluation of the possible influence of different EPC in different invertebrate and fish taxa on uptake in the black-crowned night heron was evaluated. This evaluation was based on an assessment of the dietary items contributing most to risk.

Because the daily intake of a given chemical may not be the same from all dietary sources, an evaluation of the major pathways was made in order to elucidate from where the risk may be originating for each chemical. This evaluation was conducted by dividing the daily uptake for each individual dietary component (e.g., invertebrates) by the total daily uptake. The results are summarized in Table 39 (max EPCs) and Table 40 (average exposures). The worksheets used to derive the percentages of risk attributed to each dietary item are provided in Appendix E. These results are discussed on a chemical specific basis below.

7.7.1.2.1 Modification of HQs Based on Different Invertebrate Taxa

Maximum EPC

For the night heron, NOAEL HQs based on maximum exposures exceeded one for 12 metals and three pesticides. The invertebrate ingestion pathway was a significant component of total risk for antimony, beryllium, cobalt, thallium, vanadium, and the pesticides (Table 39). For all of these COPC, the invertebrate EPC was based on the sediment EPC and the BSAF, not on a direct measure of a biological tissue concentration. Therefore, adjusting the invertebrate EPC to account for variations in concentrations between taxa would not change the risk picture for these COPC.

Average EPC

For the night heron, NOAEL HQs based on average exposures exceeded one for five metals and three pesticides. The invertebrate ingestion pathway was a significant component of total risk for antimony, thallium, and the pesticides (Table 40). For all of these COPC, the invertebrate EPC was based on the sediment EPC and the BSAF, not on a direct measure of a biological tissue concentration. Therefore, adjusting the invertebrate EPC to account for variations in concentrations between taxa would not change the risk picture for these COPC.

7.7.1.2.2 Modification of HQs Based on Different Fish Species

Maximum EPC

For the night heron, NOAEL HQs based on maximum exposures exceeded one for 12 metals and three pesticides. The fish ingestion pathway was a significant component of total risk for methylmercury only (Table 39). For methylmercury, an adjustment was made based on the different concentrations of methylmercury between fish species ingested by the night heron (Table F-3). The highest HQs were those based on ingestion of largemouth bass and pickerel. Those based on the other fish species were much lower, with no LOAEL-based HQs greater than one. As the heron is more likely to feed on bullheads and bluegill than largemouth bass and pickerel, the HQs for methylmercury based on ingestion of the former species more likely reflect risk to the heron in Grove Pond. The HQs based on ingestion of smaller, lower trophic level forage fish species suggest less risk to the heron than do HQs resulting from exposure to mercury in the bass and pickerel.

Average EPC

The NOAEL HQs based on average exposures exceeded one for five metals and three pesticides. The fish ingestion pathway was a significant component of total risk for methylmercury and DDE only (Table 40). For both of these COPC, the NOAEL-based HQs were slightly greater than one and the LOAEL-based HQs were below one; therefore, adjusting the fish EPC to account for variations in concentrations between species would not change the risk picture significantly for these COPC.

7.7.1.3 Residual Risk Evaluation for the Grove Pond Black-Crowned Night Heron

The RR derivation is presented in Appendix G and summarized in Table 41 (maximum EPC) and Table 42 (average EPC). The RR for maximum exposures (Table 41) were greater than one for all COPC, suggesting that risk to the heron from maximum exposures cannot be attributed to background conditions. The RR for average exposures (Table 42), on the other hand, were less than one for methylmercury and DDE. This suggests that risk from these chemicals to the night heron foraging throughout Grove Pond is due to background conditions.

7.7.1.4 Chemical-Specific Risk Characterization for the Grove Pond Black-Crowned Night Heron

The chemicals that present potential unacceptable risk for the night heron are those with elevated HQs based on average exposures. For night heron foraging in Grove Pond, the following chemicals merit the most concern based on HQs:

Antimony

Hazard quotients suggest that antimony poses potential risk to the black-crowned night heron, with NOAEL-based and LOAEL-based HQs of 14 and 1.4, respectively (Table 38). Antimony was only detected in 2 of 120 sediment samples analyzed, however. Invertebrates and frogs were determined to be the significant sources of antimony in the black-crowned night heron food chain model. This is because all EPCs are modeled from the sediment EPC. In most samples in Grove Pond, sediment concentrations were ND, and modeled dietary concentrations would be ND as well.

Another factor that plays a role in the elevated HQs for antimony is that the BSAF for antimony is a default value of 0.9, from EPA (1999b). This BSAF may overestimate bioaccumulation in aquatic biota. Antimony is not known to be highly bioaccumulative and HAZWRAP (1994) lists a soil-invert bioaccumulation factor (BAF) of 0.5. Further, antimony was not detected in fish tissue samples in Grove Pond.

Given the very low frequency of detection and the uncertainty associated with the BSAF for antimony, the high HQs do not equate to unacceptable risk for the night heron.

Chromium

Hazard quotients suggest that chromium poses unacceptable potential risk to the black-crowned night heron. While sediment concentrations averaged 5860 mg/kg, concentrations in dietary items were much lower, with invertebrate tissue having the highest average (1.25 mg/kg). Incidental ingestion of sediment is, therefore, the main pathway driving risk for the heron (Table 40). A back-calculation shows that any sediment concentration greater than about 900 mg/kg would yield a LOAEL-based HQ greater than one. While the highest concentrations of chromium were detected in Tannery Cove, concentrations greater than 586 mg/kg were detected in many areas of the pond. The risk to the black-crowned night heron from incidental ingestion of chromium is considered high.

Other Chemicals

Lead, methylmercury, thallium, DDE, DDE, and DDT all had all had HQs based on average EPCs and NOAEL TRVs greater than one. All of these HQ were low, however, with those for methylmercury and DDD (4.2 for both) being the highest and none of the HQs based on LOAEL TRVs exceeded one for these chemicals. Given the low HQs, plus the likelihood that risk would be even lower if based on species of fish more likely to be eaten, along with the low RR for mercury, risk to the black-crowned night heron from these chemicals is considered minimal.

7.7.1.5 Summary

While maximum HQs were high for some chemicals, the night heron probably does not forage only in areas with maximum COPC. For the night heron foraging throughout Grove Pond, a few COPC present potential risk based on $HQ_{average}$. Based on the above chemical-specific evaluation, however, most chemicals present low risk to the black-crowned night heron. The exception is chromium, which poses unacceptable risk. Because of chromium, overall risk to the black-crowned night heron in Grove Pond is considered high. There is significant uncertainty associated with this conclusion, however, because risk is based on incidental ingestion of sediment. The uncertainty associated with the estimated sediment ingestion rate is discussed in Section 7.10.

7.7.1.6 Weight of Evidence Integration

Assessment Endpoint:
Protect the long-term health of local carnivorous bird populations (represented by the black-crowned night heron)

Measurement Endpoints:
A. Compare calculated total daily doses against target receptor TRVs

Weight-of-Evidence Integration

	Weight (from Table 8)				
Risk/MAGNITUDE	Low	Low-Medium	Medium	Medium-High	High
Yes/High				**A**	
Yes/Medium					
Yes/Low					
Indeterminate					
No Risk					

Summary:

One line of evidence was used to assess the potential risk to carnivorous birds, represented by the black-crowned night heron foraging in Grove Pond. Comparing COPC-specific TDDs derived from food chain modeling to COPC-specific TRVs derived from the literature was given a medium-high weight. This approach identified risk (average HQ_{LOAEL} >1.0) for antimony and chromium. Antimony exceeded its effect HQ by only a small margin (average HQ_{LOAEL} = 1.4).

The residual risk calculations indicate that most of the risk from chromium is site-related and associated almost exclusively with sediment ingestion. Overall, the available evidence suggests that there is the potential for significant risk from chromium to carnivorous birds foraging in Grove Pond

7.7.2 Plow Shop Pond Black-Crowned Nigh Heron

7.7.2.1 Measurement Endpoint: Hazard Quotients based on NOAEL and LOAEL TRVs

The measurement endpoint was a comparison of an estimated daily intake with a literature-derived TRV for birds to calculate an HQ. Both NOAEL and LOAEL TRVs were used to obtain a range of risk values for each COPC. However, the potential for unacceptable risk was assumed to be present only if the average HQ_{LOAEL} exceeded 1.0. Hazard quotients for the black-crowned night heron foraging in Plow Shop Pond are shown in Table 51 (maximum EPCs) and Table 52 (average EPCs).

Hazard quotients for the black-crowned night heron based on maximum EPCs and NOAEL TRVs were greater than one for 10 metals and three pesticides (Table 51). Hazard quotients were between one and 10 for aluminum, arsenic, cobalt, lead, inorganic mercury, vanadium, and DDT. Hazard quotients were between 10 and 100 for antimony, methylmercury, DDD, and DDE. The highest NOAEL-based HQ_{max} were for chromium (202) and thallium (649).

Hazard quotients for the black-crowned night heron based on maximum EPCs and LOAEL TRVs were greater than one for six metals and two pesticides (Table 51). Hazard quotients were between one and 10 for antimony, arsenic, inorganic mercury, methylmercury, DDD, and DDE. The highest LOAEL-based HQ_{Max} were for chromium (40) and thallium (65).

Because it is unlikely that wildlife receptors forage only in areas with the highest COPC concentrations, HQs were also determined for exposures to average EPCs for site media. Hazard quotients for the black-crowned night heron based on average EPCs and NOAEL TRVs were greater than one for four metals and two pesticides (Table 52). Hazard quotients were between one and 10 for methylmercury, DDD, and DDE. Hazard quotients were between 10 and 100 for antimony and chromium. The highest NOAEL-based $HQ_{average}$ was for thallium (515).

Hazard quotients for the black-crowned night heron based on average EPCs and LOAEL TRVs were greater than one for three metals (Table 40). These were antimony (2), chromium (2.5), and thallium (51).

7.7.2.2 Modification of HQs Based on Different Prey Items

The black-crowned night heron is not likely to ingest all fish and invertebrate prey items equally. For example, the heron is more likely to feed on crayfish than odonate larvae and on small fish species than largemouth bass. Therefore, an evaluation of the possible influence of different EPC in different invertebrate and fish taxa on uptake in the black-crowned night heron was evaluated. This evaluation was based on an assessment of the dietary items contributing most to risk.

Because the daily intake of a given chemical may not be the same from all dietary sources, an evaluation of the major pathways was made in order to elucidate from where the risk may be originating for each chemical. This evaluation was conducted by dividing the daily uptake for each individual dietary component (e.g., invertebrates) by the total daily uptake. The results are summarized in Table 39 (max EPCs) and Table 40 (average exposures). The worksheets used to derive the percentages of risk attributed to each dietary item are provided in Appendix E. These results are discussed on a chemical specific basis below.

7.7.2.2.1 Modification of HQs Based on Different Invertebrate Taxa

Maximum EPC

For the night heron, NOAEL HQs based on maximum exposures exceeded one for ten metals and three pesticides. The invertebrate ingestion pathway was a significant component of total risk for antimony, cobalt, thallium, vanadium, and the pesticides (Table 39). For all of these COPC, the invertebrate EPC was based on the sediment EPC and the BSAF, not on a direct measure of a biological tissue concentration. Therefore, adjusting the invertebrate EPC to account for variations in concentrations between taxonomic groups would not change the risk picture for these COPC.

Average EPC

The NOAEL HQs based on average exposures exceeded one for four metals and two pesticides. The invertebrate ingestion pathway was a significant component of total risk for antimony, thallium, and the pesticides. For all of these COPC, the invertebrate EPC was based on the sediment EPC and the BSAF, not on a direct measure of a biological tissue concentration. Therefore, adjusting the invertebrate EPC to account for variations in concentrations between taxonomic groups would not change the risk picture for these COPC.

7.7.2.2.2 Modification of HQs Based on Different Fish Species

Maximum EPC

For the night heron, NOAEL HQs based on maximum exposures exceeded one for ten metals and three pesticides. The fish ingestion pathway was a significant component of total risk for methylmercury only (Table 39). For methylmercury an adjustment was made based on the different concentrations between fish species (Table F-4). The largemouth bass-based HQ is the same as the all-species maximum, i.e., the highest of the four fish species evaluated. The HQs based on ingestion of bullhead, bluegill, and crappie only were reduced, with a LOAEL HQ less than one based on ingestion of bullhead and slightly greater than one for ingestion of bluegill and black crappie. The night heron probably feeds more on the three smaller species than on largemouth bass, and while the differences were not dramatic between species, the HQs for the heron based on ingestion of smaller fish are probably more reflective of actual site risk in Plow Shop Pond.

Average EPC

For the night heron, NOAEL HQs based on average exposures exceeded one for four metals and two pesticides. The fish ingestion pathway was a significant component of total risk for methylmercury, DDD, and DDE (Table 40). For DDD and DDE, the NOAEL-based HQs were only slightly greater than one and the LOAEL-based HQs were below one; therefore, adjusting the fish EPC to account for variations in concentrations between species would not change the risk picture significantly for these COPC. For methylmercury (NOAEL HQ=9.3), an adjustment was made based on the different concentrations between fish species (Table F-5). The largemouth bass-based HQ was the highest of the four fish species evaluated. The HQs based on ingestion of bullhead, bluegill, and crappie only were reduced, with LOAEL HQs less than one. The night heron probably feeds more on the three smaller species than on largemouth bass, and while the differences were not dramatic between species, the HQs for the heron based on ingestion of the smaller fish are probably more reflective of actual site risk in Plow Shop Pond.

7.7.2.3 Residual Risk Evaluation for the Plow Shop Pond Black-Crowned Night Heron

The RR derivation is presented in Appendix G and summarized in Table 41 (maximum EPC) and Table 42 (average EPC). For the heron in Plow Shop Pond, the RR for maximum exposures were greater than one for all COPC (Table 41), suggesting that risk to from maximum exposures cannot be attributed to background conditions. The RR for average exposures (Table 42), on the other hand, were less than one for methylmercury and DDE. This suggests that risk from these chemicals to the night heron foraging throughout Plow Shop Pond is due to background conditions.

7.7.2.4 Chemical-Specific Risk Characterization for the Plow Shop Pond Black-Crowned Night Heron

The chemicals that present potential unacceptable risk for the night heron are those with elevated HQs based on average exposures. For night heron foraging in Plow Shop Pond, the following chemicals merit the most concern based on HQs:

Antimony

Antimony was only detected in 5 of 63 sediment samples in Plow Shop Pond, four of which were located adjacent to the Railroad Roundhouse, suggesting an antimony source in this area. The pond average concentration (15 mg/kg) seems to be driven by a few samples with high detection limits. Of the samples with ND values, most had detection limits less than ten but a small number of samples had detection limits much greater. The few samples with high detection limits have a disproportionate effect on the site average concentration.

Ingestion of invertebrates and frogs, as well as incidental ingestion of sediment, are all significant sources of antimony in the black-crowned night heron food chain model. This is because all EPCs are modeled from the sediment EPC. In most samples in Plow Shop Pond, sediment concentrations are low or ND, and modeled dietary concentrations would be low or ND as well.

Another factor that plays a role in the HQ calculation for antimony is that the BSAF for antimony is a default value of 0.9, from EPA (1999b). This BSAF may overestimate bioaccumulation in aquatic biota. Antimony is not known to be highly bioaccumulative and HAZWRAP (1994) lists a soil-invert bioaccumulation factor (BAF) of 0.5. Further, antimony was not detected in fish tissue samples in Plow Shop Pond.

Given the limited aerial extent of antimony detections in Plow Shop Pond and the uncertainty associated with the BSAF for antimony, the high HQs do not necessarily equate to unacceptable risk for the black-crowned night heron.

Chromium

Hazard quotients suggest that chromium poses unacceptable potential risk to the black-crowned night heron in Plow Shop Pond. While sediment concentrations averaged 2273 mg/kg, concentrations in dietary items were much lower, with frog tissue having the highest average (1.65 mg/kg). Incidental ingestion of sediment is, therefore, the main pathway driving risk for the heron. A back-calculation shows that a sediment concentration of approximately 900 mg/kg would yield a LOAEL-based HQ greater than one. Concentrations greater than 900 mg/kg were detected in many areas of the pond. The risk to the black-crowned night heron from incidental ingestion of chromium is considered high.

Methylmercury

The Hazard quotients for methylmercury suggest potential risk to the black-crowned night heron in Plow Shop Pond, with an average NOAEL-based HQ of 9.3. The HQs based on ingestion of smaller species more likely to be ingested by the heron were lower, as discussed in Section 7.7.2.2.2. In addition, the average RR for the black-crowned night heron in Plow Shop Pond is less than one, suggesting that risk from methylmercury can be attributed to background contributions to the pond. The site-related risk to the night heron, therefore, is considered low.

Thallium

The highest HQs for the black-crowned night heron in Plow Shop Pond were for thallium. Risk from exposure to thallium is based directly on sediment concentrations because food items were modeled using a default BSAF of 0.9 from EPA (1999b). This BSAF is thought to be overly conservative. Thallium was not detected in any of the 20 fish samples collected in Plow Shop Pond.

Thallium was only detected in three of 48 samples in Plow Shop Pond, all from one sampling effort, the 1998 samples labeled PSEM-1 through PSEM-3. The site EPC were based on these samples only, as inclusion of ND values would have resulted in an unrealistically high average based on ½ DL values. Given the low frequency of detection and the likely overestimation of bioaccumulation for thallium, the elevated HQs for thallium may not equate to unacceptable risk.

Other Chemicals

DDD and DDE had HQs based on average EPCs and NOAEL TRVs greater than one. Both of these HQ were barely greater than one, however, with LOAEL TRVs less than one for both pesticides. Given these low HQs, plus the low average RR for DDE, risk to the black-crowned night heron from pesticides is considered minimal.

7.7.2.5 Summary

While maximum HQs were high for some chemicals, the night heron probably does not forage only in areas with maximum COPC. For the night heron foraging throughout Plow Shop Pond, a few COPC present potential risk based on $HQ_{average}$. Based on the above chemical-specific evaluation, however, most chemicals present low risk to the black-crowned night heron. The exception is chromium, which poses unacceptable risk. Because of chromium, overall risk to the black-crowned night heron in Plow Shop Pond is considered high. There is significant uncertainty associated with this conclusion, however, because risk is based on incidental ingestion of sediment. The uncertainty associated with the estimated sediment ingestion rate is discussed in Section 7.10.

7.7.2.6 Weight of Evidence Integration - Plow Shop Pond

Assessment Endpoint:
Protect the long-term health of local carnivorous bird populations (represented by the black-crowned night heron)

Measurement Endpoints:
A. Compare calculated total daily doses against target receptor TRVs

Weight-of-Evidence Integration

	Weight (from Table 8)				
Risk/MAGNITUDE	Low	Low-Medium	Medium	Medium-High	High
Yes/High				**A**	
Yes/Medium					
Yes/Low					
Indeterminate					
No Risk					

Summary:

One line of evidence was used to assess the potential risk to carnivorous birds, represented by the black-crowned night heron foraging in Plow Shop Pond. Comparing COPC-specific TDDs derived from food chain modeling to COPC-specific TRVs derived from the literature was given a medium-high weight. This approach identified risk (average HQ_{LOAEL} >1.0) for antimony, chromium, and thallium. The risk from antimony and thallium results from conservative bioaccumulation factors, high analytical detection limits, or low detection frequencies. However, the high risk from chromium appears to be site-specific and associated almost exclusively with sediment ingestion. Overall, the available evidence indicates that there is the potential for significant risk from chromium to carnivorous birds foraging in Plow Shop Pond.

7.8 ASSESSMENT ENDPOINT 7: PISCIVOROUS BIRD POPULATIONS

The assessment endpoint was the protection of piscivorous birds foraging in the pond, to insure that ingestion of chemicals in food items and surface water does not have a negative impact on growth, survival, and reproduction. *Are the levels of contaminants in surface water and aquatic prey sufficiently high to impair piscivorous bird populations foraging in Grove Pond and Plow Shop Pond?*

7.8.1 Grove Pond Belted Kingfisher

7.8.1.1 Measurement Endpoint: Hazard Quotients based on NOAEL and LOAEL TRVs

The measurement endpoint was a comparison of an estimated daily intake with a literature-derived TRV for birds to calculate an HQ. Both NOAEL and LOAEL TRVs were used to obtain a range of risk values for each COPC. However, the potential for unacceptable risk was assumed to be present only if the average HQ_{LOAEL} exceeded 1.0. Hazard quotients for the belted kingfisher foraging in Grove Pond are shown in Table 53 (maximum EPCs) and Table 54 (average EPCs).

Hazard quotients for the belted kingfisher based on maximum EPCs and NOAEL TRVs were greater than one for two metals, two pesticides, and total PCBs (Table 53). Hazard quotients were between one and 10 for lead, DDD, DDE, and total PCBs. The highest NOAEL-based HQ_{Max} was for methylmercury (84).

Hazard quotients for the belted kingfisher based on maximum EPCs and LOAEL TRVs were greater than one only for methylmercury (8.4) (Table 53).

Because it is unlikely that wildlife receptors forage only in areas with the highest COPC concentrations, HQs were also determined for exposures to average EPCs for site media. Hazard quotients for the belted kingfisher based on average EPCs and NOAEL TRVs were greater than one for methylmercury (15), DDD (1.4), and DDE (3.1) (Table 54).

Hazard quotients for the belted kingfisher based on average EPCs and LOAEL TRVs were greater than one only for methylmercury (1.5) (Table 54).

7.8.1.2 Modification of HQs Based on Different Prey Items

The belted kingfisher is not likely to ingest all fish species equally. For example, it is more likely to feed on small fish species than on largemouth bass. Therefore, an evaluation of the possible influence of different EPC in different fish taxa on uptake in the belted kingfisher was evaluated. This evaluation was based on an assessment of the dietary items contributing most to risk.

Because the daily intake of a given chemical may not be the same from all dietary sources, an evaluation of the major pathways was made in order to elucidate from where the risk may be originating for each chemical. This evaluation was conducted by dividing the daily uptake for each individual dietary component (e.g., invertebrates) by the total daily uptake. The results are summarized in Table 39 (max EPCs) and Table 40 (average exposures). The worksheets used to derive the percentages of risk attributed to each dietary item are provided in Appendix E. These results are discussed on a chemical specific basis below.

7.8.1.2.1 Modification of HQs Based on Different Invertebrate Taxa

Invertebrates were not part of the kingfisher diet.

7.8.1.2.2 Modification of HQs Based on Different Fish Species

Maximum EPC

For the kingfisher, NOAEL HQs based on maximum exposures exceeded one for lead, methylmercury, DDD, DDE, and total PCBs. The fish ingestion pathway accounts for essentially all (with a negligible input from surface water) of the risk to the kingfisher (Table 39). For lead, DDD and PCBs, the NOAEL-based HQs were slightly greater than one and the LOAEL-based HQs were below one; therefore, adjusting the fish EPC to account for variations in concentrations between species would not change the risk picture significantly for these pesticides. For methylmercury and DDE, adjustments were made based on the different concentrations of these COPC between fish species (Table F-6). For methylmercury, the highest HQs were those based on ingestion of largemouth bass (84 [NOAEL] and 8.4 [LOAEL]) and pickerel (45 [NOAEL] and 4.5 [LOAEL]). Those based on the other fish species were much lower, with NOAEL-based HQs ranging from <1 (crappie) to 17 (bluegill) and LOAEL-based HQs greater than one for the bluegill only (1.7). Similarly, for DDE, the highest HQ was that based ingestion of largemouth bass, with those based on other species somewhat lower. As the kingfisher is more likely to feed on bullheads and bluegill than largemouth bass and pickerel, the HQs for methylmercury and DDE based on ingestion of the former species more likely reflect risk to the kingfisher in Grove Pond. The HQs based on ingestion of smaller, lower trophic level forage fish species suggest low risk to the kingfisher exposed to maximum fish EPCs.

Average EPC

For the kingfisher, NOAEL HQs based on average exposures exceeded one for methylmercury, DDD, and DDE. The fish ingestion pathway accounts for essentially all risk to the kingfisher. For the pesticides, the NOAEL-based HQs were slightly greater than one and the LOAEL-based HQs were below one; therefore, adjusting the fish EPC to account for variations in concentrations between species would not change the risk picture significantly for these pesticides. For methylmercury, an adjustment was made based on the different concentrations between fish species (Table F-7). As the kingfisher is more likely to feed on bullheads and bluegill than largemouth bass and pickerel, the HQs for methylmercury based on ingestion of the former species more likely reflect risk to the kingfisher in Grove Pond. Adjusted LOAEL HQs based on ingestion of the smaller species were greater than one only for the bluegill (1.2), suggesting low risk to the kingfisher exposed to average fish EPCs in Grove Pond.

7.8.1.3 Residual Risk Evaluation for the Grove Pond Belted Kingfisher

The RR derivation is presented in Appendix G and summarized in Table 41 (maximum EPC) and Table 42 (average EPC). For the belted kingfisher, the maximum RR in Grove Pond were greater than one for all COPC except DDE (Table 41), suggesting that risk from maximum exposures can be attributed to background conditions only for DDE. The RR for average exposures (Table 42) were also less than one only for DDE, but only slightly greater than one for methylmercury. This suggests that most of the risk from methylmercury and DDE to the kingfisher foraging throughout Grove Pond is due to background conditions.

7.8.1.4 Chemical-Specific Risk Characterization for the Grove Pond Belted Kingfisher

The chemicals that present potential unacceptable risk for the kingfisher are those with elevated HQs based on average exposures. For kingfisher foraging in Grove Pond, the following chemicals merit the most concern based on HQs:

Methylmercury

The highest HQs for methylmercury suggest potential risk to the belted kingfisher in Grove Pond, with an average NOAEL-based HQ of 15. The HQs based on ingestion of fish species more likely to be ingested by the kingfisher were lower, however, as discussed in Section 7.8.1.2.2. In addition, the average RR for the kingfisher in Grove Pond was only 1.1, suggesting that most of the risk from methylmercury can be attributed to background contributions to the pond. The site-related risk to the kingfisher from methylmercury is considered low.

Other Chemicals

Two pesticides, DDD and DDE, had NOAEL-based HQs for average exposures greater than one. The HQs were slightly greater than one, however, and the LOAEL-based HQs were less than one. Risk from these chemicals to the kingfisher foraging throughout Grove Pond is considered minimal.

7.8.1.5 Summary

While maximum HQs were high for some chemicals, the kingfisher probably does not forage only in areas with maximum COPC. For the kingfisher foraging throughout Grove Pond, a few COPC present had $HQ_{average}$ greater than one. Based on the above chemical-specific evaluation, however, these COPC present low risk to the belted kingfisher.

7.8.1.6 Weight of Evidence Integration

Assessment Endpoint:
Protect the long-term health of local piscivorous bird populations (represented by the belted kingfisher)

Measurement Endpoints:
A. Compare calculated total daily doses against target receptor TRVs

Weight-of-Evidence Integration

	Weight (from Table 8)				
Risk/MAGNITUDE	Low	Low-Medium	Medium	Medium-High	High
Yes/High					
Yes/Medium					
Yes/Low					
Indeterminate					
No Risk				**A**	

Summary:

One line of evidence was used to assess the potential risk to piscivorous birds, represented by the belted kingfisher foraging in Grove Pond. Comparing COPC-specific TDDs derived from food chain modeling to COPC-specific TRVs derived from the literature was given a medium-high weight. This approach identified no risk for any of the COPCs, except for methyl mercury (average HQ_{LOAEL} = 1.5). The RR calculations indicated that most of that small risk originated from background conditions. Overall, the available evidence shows that there is no significant risk to piscivorous birds foraging in Grove Pond.

7.8.2 Plow Shop Pond Belted Kingfisher

7.8.2.1 Measurement Endpoint: Hazard Quotients based on NOAEL and LOAEL TRVs

The measurement endpoint was a comparison of an estimated daily intake with a literature-derived TRV for birds to calculate an HQ. Both NOAEL and LOAEL TRVs were used to obtain a range of risk values for each COPC. However, the potential for unacceptable risk was assumed to be present only if the average HQ_{LOAEL} exceeded 1.0. Hazard quotients for the belted kingfisher foraging in Plow Shop Pond are shown in Table 55 (maximum EPCs) and Table 56 (average EPCs).

Hazard quotients for the belted kingfisher based on maximum EPCs and NOAEL TRVs were greater than one for one metal and two pesticides (Table 55). The HQ for DDD was 3.9. The highest NOAEL-based HQ_{max} were for methylmercury (198) and DDE (13).

Hazard quotients for the belted kingfisher based on maximum EPCs and LOAEL TRVs were greater than one for methylmercury (20) and DDE (1.3) (Table 55).

Because it is unlikely that wildlife receptors forage only in areas with the highest COPC concentrations, HQs were also determined for exposures to average EPCs for site media. Hazard quotients for the belted kingfisher based on average EPCs and NOAEL TRVs were greater than one for two COPC, DDE (2.9) and methylmercury (45) (Table 56).

Hazard quotients for the belted kingfisher based on average EPCs and LOAEL TRVs were greater than one only for methylmercury (4.5) (Table 56).

7.8.2.2 Modification of HQs Based on Different Prey Items

The belted kingfisher is not likely to ingest all fish species equally. For example, it is more likely to feed on small fish species than largemouth bass. Therefore, an evaluation of the possible influence of different EPC in different fish species on uptake in the kingfisher was evaluated. This evaluation was based on an assessment of the dietary items contributing most to risk.

Because the daily intake of a given chemical may not be the same from all dietary sources, an evaluation of the major pathways was made in order to elucidate from where the risk may be originating for each chemical. This evaluation was conducted by dividing the daily uptake for each individual dietary component (e.g., invertebrates) by the total daily uptake. The results are summarized in Table 39 (max EPCs) and Table 40 (average exposures). The worksheets used to derive the percentages of risk attributed to each dietary item are provided in Appendix E. These results are discussed on a chemical specific basis below.

7.8.2.2.1 Modification of HQs Based on Different Invertebrate Taxa

Invertebrates were not part of the kingfisher diet.

7.8.2.2.2 Modification of HQs Based on Different Fish Species

Maximum EPC

For the kingfisher, NOAEL HQs based on maximum exposures exceeded one for methylmercury, DDD, and DDE. The fish ingestion pathway accounts for all risk to the kingfisher. For DDD, the NOAEL-based HQ was slightly greater than one and the LOAEL-based HQ was below one; therefore, adjusting the fish EPC to account for variations in concentrations between species would not change the risk picture significantly for these pesticides. For methylmercury and DDE, adjustments were made based on the different concentrations between fish species (Table F-8). The HQs based on exposure to the different fish species are not dramatically different for DDE, although the LOAEL HQs were less than one based on consumption of bullhead, bluegill, and crappie versus 1.3 for largemouth bass. For methylmercury, HQs were much lower (LOAEL HQs in the single digits) when based on exposure to bullhead, bluegill, and black crappie, compared to 20 for largemouth bass. The kingfisher probably feeds more on the three smaller species than on largemouth bass and the methylmercury and DDE HQs for the kingfisher based on ingestion of the smaller fish are probably more reflective of actual site risk in Plow Shop Pond. These adjusted HQs suggest medium risk for the kingfisher exposed to methylmercury at maximum EPC in Plow Shop Pond.

Average EPC

For the kingfisher, NOAEL HQs based on average exposures exceeded one for methylmercury and DDE. The fish ingestion pathway accounts for all risk to the kingfisher. For the DDE, the NOAEL-based HQ was slightly greater than one and the LOAEL-based HQ was below one; therefore, adjusting the fish EPC to account for variations in concentrations between species would not change the risk picture significantly for DDE. For methylmercury, an adjustment was made based on the different concentrations between fish species (Table F-9). The NOAEL-based HQs ranged from 21 for bullhead consumption to 101 for consumption of largemouth bass, and LOAEL-based HQs were in the single digits for the smaller species compared to10.1 for consumption of largemouth bass. The kingfisher likely feeds on the smaller species and the HQs based on ingestion of these species may more accurately reflect risk to the kingfisher than do the HQs based on ingestion of largemouth bass. These revised risk values suggest medium risk from mercury to the belted kingfisher foraging throughout Plow Shop Pond.

7.8.2.3 Residual Risk Evaluation for the Plow Shop Pond Belted Kingfisher

The RR derivation is presented in Appendix G and summarized in Table 41 (maximum EPC) and Table 42 (average EPC). For the belted kingfisher in Plow Shop Pond, the RR for maximum exposures (Table 41) were greater than one for all COPC, suggesting that risk to from maximum exposures cannot be attributed to background conditions. The RR for average exposures (Table

42), on the other hand, were less than one for DDD and DDE. This suggests that risk from these chemicals to the kingfisher foraging throughout Plow Shop Pond is due to background conditions.

7.8.2.4 Chemical-Specific Risk Characterization for the Plow Shop Pond Belted Kingfisher

The chemicals that present potential unacceptable risk for the kingfisher are those with elevated HQs based on average exposures. For kingfisher foraging in Plow Shop Pond, the following chemicals merit the most concern based on HQs:

Methylmercury

The maximum and average fish tissue concentrations collected in Plow Shop Pond were 4.0 mg/kg and 0.98, respectively. The highest concentrations were from largemouth bass in the 1992 sample collection. These larger fish are probably less likely to be caught by most piscivorous birds. Maximum and averages from the most recent round of collections, which focused on more probable forage fish species, were 0.7 mg/kg and 0.4 mg/kg, respectively. Maximum and average concentrations from Flannagan Pond were 0.3 mg/kg and 0.19, respectively. Concentrations in Plow Shop Pond were higher than those in Flannagan Pond, but may not be out of the ordinary, particularly for an impoundment, and will likely remain high with atmospheric inputs of mercury alone.

Methylmercury

The Hazard quotients for methylmercury suggest potential risk to the kingfisher in Plow Shop Pond, with an average NOAEL-based HQ of 45, which was driven by the HQ for ingestion of largemouth bass (101). The HQs based on ingestion of smaller species more likely to be ingested by the heron were lower, as discussed in Section 7.8.2.2.2. The resultant LOAEL-based HQs for ingestion of the smaller species were in the single digits, suggesting medium-level risk from methylmercury to the kingfisher in Plow Shop Pond.

Other Chemicals

The HQ based on average EPCs and NOAEL TRVs for DDE was greater than one. The LOAEL-based HQ was below one, however. Given these low HQs and the low RR for DDE, risk to the belted kingfisher in Plow Shop pond is considered minimal.

7.8.2.5 Summary

While maximum HQs were high for some chemicals, the kingfisher probably does not forage only in areas with maximum COPC. For the kingfisher foraging throughout Plow Shop Pond, a few COPC present potential risk based on $HQ_{average}$. Based on the above chemical-specific evaluation, however, most chemicals present low risk to the kingfisher. The exception is methylmercury. Because of methylmercury, overall risk to the belted kingfisher in Plow Shop Pond is considered medium.

7.8.2.6 Weight of Evidence Integration

Assessment Endpoint:
Protect the long-term health of local piscivorous bird populations (represented by the belted kingfisher)
Measurement Endpoints:
A. Compare calculated total daily doses against target receptor TRVs

Weight-of-Evidence Integration

	Weight (from Table 8)				
Risk/MAGNITUDE	Low	Low-Medium	Medium	Medium-High	High
Yes/High					
Yes/Medium				**A**	
Yes/Low					
Indeterminate					
No Risk					

Summary:

One line of evidence was used to assess the potential risk to piscivorous birds, represented by the belted kingfisher foraging in Plow Shop Pond. Comparing COPC-specific TDDs derived from food chain modeling to COPC-specific TRVs derived from the literature was given a medium-high weight. This approach identified no risk for any of the COPCs, except for methyl mercury (average HQ_{LOAEL} = 4.5). The RR calculations indicated that most of that risk originated from within Plow Shop Pond. Overall, the available evidence shows that there is the potential for medium risk to piscivorous birds foraging in Plow Shop Pond

7.9 ASSESSMENT ENDPOINT 8: INSECTIVOROUS BIRD POPULATIONS

The assessment endpoint was the protection of insectivorous birds to insure that ingestion of chemicals in food items does not have a negative impact on growth, survival, and reproduction.

Are the levels of contaminants in surface water and aquatic prey sufficiently high to impair insectivorous bird populations foraging in Grove Pond and Plow Shop Pond?

7.9.1 Grove Pond Tree Swallow

7.9.1.1 Measurement Endpoint: Hazard Quotients based on NOAEL and LOAEL TRVs

The measurement endpoint was a comparison of an estimated daily intake with a literature-derived TRV for birds to calculate an HQ. Both NOAEL and LOAEL TRVs were used to obtain a range of risk values for each COPC. However, the potential for unacceptable risk was assumed to be present only if the average HQ_{LOAEL} exceeded 1.0. Hazard quotients for the tree swallow foraging in Grove Pond are shown in Table 57 (maximum EPCs) and Table 58 (average EPCs).

Hazard quotients for the tree swallow based on maximum EPCs and NOAEL TRVs were greater than one for four of the six metals analyzed in stomach contents (Table 57). Hazard quotients were between one and 10 for arsenic and lead. Hazard quotients were between 10 and 100 for methylmercury (28). The highest NOAEL-based HQ_{Max} was for chromium (1124).

Hazard quotients for the tree swallow based on maximum EPCs and LOAEL TRVs were greater than one for methylmercury (2.8) and for chromium (225) (Table 57).

Because it is unlikely that wildlife receptors forage only in areas with the highest COPC concentrations, HQs were also determined for exposures to average EPCs for site media. Hazard quotients for the tree swallow based on average EPCs and NOAEL TRVs were greater than one for three metals (Table 58). Hazard quotients were between one and 10 for lead. Hazard quotients were between 10 and 100 for methylmercury (20). The highest NOAEL-based HQ_{Avg} was for chromium (199).

Hazard quotients for the tree swallow based on average EPCs and LOAEL TRVs were greater than one for methylmercury (2) and chromium (40) (Table 58).

7.9.1.2 Chemical-Specific Risk Characterization for the Grove Pond Tree Swallow

The chemicals that present potential unacceptable risk for the tree swallow are those with elevated HQs based on average exposures. For the tree swallow foraging in Grove Pond, the following chemicals merit the most concern based on HQs:

<u>Chromium</u>

The maximum chromium concentration of tree swallow stomach contents was 1113 mg/kg, with a mean of 195 mg/kg. Haines and Longcore (2001) reported the occurrence of metal shavings and shards in tree swallow gizzards, which might explain the high concentrations of chromium in stomach contents. The highest concentration of chromium in Grove Pond aquatic invertebrates, which would approximate the dietary components of tree swallows, was only 3.54 mg/kg. The high chromium concentrations, therefore, are more likely the result of direct ingestion of soil or metal pieces. Chromium in these metal shavings and shards would likely be only partly bioavailable. If the metallic material were stainless steel, for example, most of the chromium would be in the Cr (0) form. While some elemental chromium might be oxidized to Cr III, the short residence time in the gut would probably be such that only a small amount of the chromium in the metal pieces would be mobilized. The risk to the tree swallow from chromium in Grove Pond is probably lower than is indicated by the HQ calculations.

Methylmercury

The maximum mercury concentration in tree swallow stomach contents was 0.272 mg/kg, with a mean of 0.198 mg/kg. Haines and Longcore (2001) reported the occurrence of metal shavings and shards in tree swallow gizzards, which might explain the high concentrations of mercury in stomach contents. The highest concentration of mercury in Grove Pond aquatic invertebrates, which would approximate the dietary components of tree swallows, was only 0.05 mg/kg. The high mercury concentrations, therefore, may be the result of direct ingestion of soil or metal pieces. If this is the case, the assumption that 65% of mercury in stomach contents is in the methyl form, is highly overestimated.

Other Chemicals

The average HQ for lead based on the NOAEL TRV was 2.2. The LOAEL-based HQ was less than one, suggesting that lead does not pose unacceptable risk to the tree swallow in Grove Pond.

7.9.1.3 Summary

While HQs for the tree swallow were high for chromium and mercury the chemical forms of chromium and mercury in swallow stomach contents are probably not fully bioavailable or toxic. Risk to the tree swallow in Grove Pond is considered low.

7.9.1.4 Weight of Evidence Integration

Assessment Endpoint:
Protect the long-term health of local insectivorous bird populations (represented by the tree swallow)

Measurement Endpoints:
A. Compare calculated total daily doses against target receptor TRVs

Weight-of-Evidence Integration

	Weight (from Table 8)				
Risk/MAGNITUDE	Low	Low-Medium	Medium	Medium-High	High
Yes/High					
Yes/Medium				**A**	
Yes/Low					
Indeterminate					
No Risk					

Summary:

One line of evidence was used to assess the potential risk to insectivorous birds, represented by the tree swallow, foraging in Grove Pond. Comparing COPC-specific TDDs derived from stomach content analysis to COPC-specific TRVs derived from the literature was given a medium-high weight. This approach identified risk from chromium (average HQ_{LOAEL} = 40) and methyl mercury (average HQ_{LOAEL} = 2.0). The RR could not be determined because stomach contents from tree swallows in the background pond were not collected. The high chromium HQ may have been due in part to the presence of metal shavings and shards found in the tree swallow gizzards, which might explain the high concentrations of chromium in stomach contents. Overall, the available evidence shows that there is the potential for medium risk to insectivorous birds foraging in Grove Pond.

7.9.2 Plow Shop Pond Tree Swallow

7.9.2.1 Measurement Endpoint: Hazard Quotients based on NOAEL and LOAEL TRVs

The measurement endpoint was a comparison of an estimated daily intake with a literature-derived TRV for birds to calculate an HQ. Both NOAEL and LOAEL TRVs were used to obtain a range of risk values for each COPC. However, the potential for unacceptable risk was assumed to be present only if the average HQ_{LOAEL} exceeded 1.0. Hazard quotients for the tree swallow foraging in Plow Shop Pond are shown in Table 59 (maximum EPCs) and Table 60 (average EPCs).

Hazard quotients for the tree swallow based on maximum EPCs and NOAEL TRVs were greater than one for four of the six metals analyzed in stomach contents (Table 59). Hazard quotients were between one and 10 for cadmium and lead. Hazard quotients were between 10 and 100 for methylmercury (22). The highest NOAEL-based HQ_{Max} was for chromium (191).

Hazard quotients for the tree swallow based on maximum EPCs and LOAEL TRVs were greater than one for methylmercury (2.2) and for chromium (38) (Table 59).

Because it is unlikely that wildlife receptors forage only in areas with the highest COPC concentrations, HQs were also determined for exposures to average EPCs for site media. Hazard quotients for the tree swallow based on average EPCs and NOAEL TRVs were greater than one for three metals (Table 60). Hazard quotients were between one and 10 for lead. Hazard quotients were between 10 and 100 for methylmercury (20). The highest NOAEL-based HQ_{Avg} was for chromium (118).

Hazard quotients for the tree swallow based on average EPCs and LOAEL TRVs were greater than one for methylmercury (2) and chromium (24) (Table 60).

7.9.2.2 Chemical-Specific Risk Characterization for the Plow Shop Pond Tree Swallow

The chemicals that present potential unacceptable risk for the tree swallow are those with elevated HQs based on average exposures. For the tree swallow foraging in Plow Shop Pond, the following chemicals merit the most concern based on HQs:

Chromium

The maximum chromium concentration of tree swallow stomach contents in Plow Shop Pond samples was 189 mg/kg, with a mean of 117 mg/kg. Haines and Longcore (2001) reported the occurrence of metal shavings and shards in tree swallow gizzards, which might explain the high concentrations of chromium in stomach contents. The highest concentration of chromium in aquatic invertebrates, which would approximate the dietary components of tree swallows, was only 3.19 mg/kg. The high chromium concentrations, therefore, are more likely the result of direct ingestion of soil or metal pieces, rather than from ingestion of emergent insects. Chromium in these metal shavings and shards would likely be only partly bioavailable. If the metallic material were stainless steel, for example, most of the chromium would be in the Cr (0) form. While some elemental chromium might be oxidized to Cr III, the short residence time in the gut would probably be such that only a small amount of the chromium in the metal pieces would be mobilized. The risk to the tree swallow from chromium in Grove Pond is probably lower than is indicated by the HQ calculations.

Methylmercury

The maximum mercury concentration of tree swallow stomach contents in Plow Shop Pond samples was 0.211 mg/kg, with a mean of 0.195 mg/kg. Haines and Longcore (2001) reported the occurrence of metal shavings and shards in tree swallow gizzards, which might explain the high concentrations of mercury in stomach contents. The highest concentration of mercury in aquatic invertebrates, which would approximate the dietary components of tree swallows, was only 0.069 mg/kg. The high mercury concentrations, therefore, may be the result of direct ingestion of soil or metal pieces. If this is the case, the assumption that 65% of mercury in stomach contents is in the methyl form is highly overestimated.

Other Chemicals

The average HQ for lead based on the NOAEL TRV was 1.1. The LOAEL-based HQ was less than one, suggesting that lead does not pose unacceptable risk to the tree swallow in Plow Shop Pond.

7.9.2.3 Summary

While HQs for the tree swallow were high for chromium and mercury the chemical forms of chromium and mercury in swallow stomach contents are probably not fully bioavailable or toxic. Risk to the tree swallow in Plow Shop Pond is considered low.

7.9.2.4 Weight of Evidence Integration

Assessment Endpoint:
Protect the long-term health of local insectivorous bird populations (represented by the tree swallow)
Measurement Endpoints:
A. Compare calculated total daily doses against target receptor TRVs

Weight-of-Evidence Integration

	Weight (from Table 8)				
Risk/MAGNITUDE	Low	Low-Medium	Medium	Medium-High	High
Yes/High					
Yes/Medium				**A**	
Yes/Low					
Indeterminate					
No Risk					

Summary:

Modify this summary as follows: “One line of evidence was used to assess the potential risk to insectivorous birds, represented by the tree swallow, foraging in Plow Shop Pond. Comparing COPC-specific TDDs derived from stomach content analysis to COPC-specific TRVs derived from the literature was given a medium-high weight. This approach identified risk from chromium (average HQ_{LOAEL} = 24) and methyl mercury (average HQ_{LOAEL} = 2.0). The RR could not be determined because stomach contents from tree swallows in the background pond were not collected. The high chromium HQ may have been due in part by the presence of metal shavings and shards found in the tree swallow gizzards, which might explain the high concentrations of chromium in stomach contents. Overall, the available evidence shows that there is the potential for medium risk to insectivorous birds foraging in Plow Shop Pond.

7.10 UNCERTAINTY ANALYSIS

7.10.1 Introduction

Uncertainty is inherent in many aspects of the ERA process, because of the inexact nature of various assumptions that influence the risk assessment results. The many assumptions made in order to evaluate risk have associated uncertainties in many cases. Factors contributing to the uncertainties in this ERA are listed below for each representative receptor group.

7.10.2 Uncertainties associated with assessing risk to water column invertebrates

7.10.2.1 Measurement endpoint A: compare surface water EPC to benchmarks

There are uncertainties associated with chemicals which were not detected in the analyses for surface water and sediment, but for which the detection limits exceeded ecological benchmarks. For example, the detection limits for beryllium, cadmium, and selenium in some Grove Pond samples were greater than the chronic surface water benchmark. Therefore, true comparisons against ecological benchmarks were not possible in all cases. This uncertainty may result in an underestimation of site risk.

There are uncertainties associated with chemicals for which surface water benchmarks do not exist. The conservative approach was to retain these chemicals as COPCs, even though their risk could not be quantified because of a lack of benchmarks.

7.10.2.2 Measurement endpoint B: surface water toxicity testing

There is inherent uncertainty associated with the surface water toxicity test: extrapolation from test species to site organisms, water quality conditions, exposure durations, etc. However, the most sensitive life stage of the test species (*C. dubia*) was exposed according to EPA-recognized standard protocols and a sensitive endpoint (reproduction) was measured. This approach adds confidence that the results showing no significant risk actually reflected a lack of toxicity to surface water organisms in the ponds.

7.10.3 Uncertainties associated with assessing risk to benthic invertebrates

7.10.3.1 Measurement endpoint A: compare sediment EPC to benchmarks

Uncertainty is associated with the spatial coverage of sediment samples in the ponds. Because contamination can vary greatly within even small distances in sediment, it is not possible to know if the locations with the greatest contamination were sampled. Given the large number of samples in the ponds, however, and the collection of samples in the suspected areas of greatest contamination (e.g. Tannery Cove in Grove Pond) it is likely that the samples represented the areas with the highest contamination.

Some benthic invertebrates have limited mobility. Therefore, they can be exposed for long periods of time to contaminants within a relatively small area of sediment. For such organisms, a risk estimated based on a mean or maximum concentration representing the entire pond may not accurately represent risk. While a more accurate method to identify risk to immobile benthic organisms would be to establish site-specific HQs, the large number of sediment samples and analytes precluded the feasibility of this approach. There is uncertainty, therefore, in the estimate of risk to benthic macroinvertebrates for taxa that are immobile and have more localized exposure units.

The very high concentrations in sediments are not reflected in aquatic organisms and it is likely that, along with the other factors discussed in the preceding text, the thick vegetative mat in both ponds acts as a barrier between chemicals in sediments and the aquatic biological community. Further, because of the think layer of peat, there is uncertainty about the actual depth of samples described as surface sediment samples. Using a ponar or other sediment sampling device, the level of confidence in identifying the exact surface layer is low. The effect of this uncertainty on risk is unclear.

There are uncertainties associated with chemicals for which sediment benchmarks do not exist. The conservative approach was to retain these chemicals as COPCs, even though their risk could not be quantified because of a lack of benchmarks.

7.10.3.2 Measurement endpoint B: sediment toxicity testing

Sediment samples collected in 2005 were used in the toxicity tests. These sample locations do not represent the locations with the highest detected concentrations for all COPC. For example, some of the highest concentrations of chemicals in sediments in Grove Pond (e.g., aluminum at 90,000 mg/kg, arsenic at 910 mg/kg, copper at 13,000 mg/kg, mercury at 422 mg/kg, DDE at 2.5 mg/kg, and total PAHs at 42 mg/kg) were much greater than the concentrations to which test organisms were exposed. Average concentrations for most chemicals were represented, however, in the toxicity test samples. Similarly, some of the highest concentrations of chemicals in sediments in Plow Shop Pond (e.g., antimony at 30.7 mg/kg, arsenic at 6800 mg/kg, cadmium at 66 mg/kg, chromium at 37,800 mg/kg, copper at 3450 mg/kg, manganese at 54800, mercury at 250 mg/kg, and DDE at 1.3 mg/kg) were much greater than the concentrations to which test organisms were exposed. Average concentrations for most chemicals were represented, however, in the toxicity test samples. Therefore, while there may be locations in both ponds that are more toxic than those used in toxicity tests, the results of the tests can be generalized to most areas of Grove Pond and Plow Shop Pond.

The two benthic species used in the toxicity tests were exposed according to EPA-recognized standard protocols. Using sensitive juvenile life stages greatly increased the likelihood of detecting toxicity. However, the relatively short duration of the test (10 days) increased the uncertainty surrounding the lack of observed toxicity for most samples. Using longer exposures and measuring reproductive output as an additional endpoint might have detected toxicity, which the shorter exposures may have been unable to do.

7.10.3.3 Measurement endpoint C: compare measured tissue residue levels to CBRs

The CBR evaluation had significant uncertainty. Critical body residues were taken from literature sources and toxicity values were generally not available for species that occur in Grove Pond and Plow Shop Pond. There is uncertainty, therefore, in the estimate of toxic potential of body burdens based on comparisons with CBRs. This uncertainty may result in underestimation or overestimation of risk.

Because of the uncertainty associated with a lack of taxonomic correspondence, the lowest CBRs available were selected. Using this approach adds to the uncertainty and probably overestimates risk to benthic invertebrates.

The limited sample sizes add uncertainty to the CBR evaluation for benthic invertebrates. For example, for crayfish for some chemicals in Grove Pond, the sample size was three. In Plow Shop Pond the sample size was one for some chemicals. This limited database for certain chemicals results in uncertainty in the conclusions about risk to benthic biota from accumulated body burdens of COPC.

7.10.3.4 AVS/SEM Evaluation

There is uncertainty associated with the inclusion of chromium in the AVS/SEM evaluation. While chromium was included in the SEM analysis, EPA (2005) suggests that chromium not be included among the SEM metals because its interaction with AVS is not via formation of an insoluble sulfide. This uncertainty is addressed in the technical argument provided in Section 7.3.4.1 to evaluate the AVS/SEM results without chromium, which suggest that the metals are not bioavailable.

The protective role of AVS and in sequestering metals and the reduction of CrVI, if present, to CrIII is dependant on sediments being anoxic. If water levels in the ponds drop, however, and expose sediments to oxygen, assumptions about the bioavailability and toxicity of metals in sediments may not be valid. This uncertainty may result in an underestimation of risk from exposure to chromium and sulfide-bound metals.

7.10.4 Uncertainties associated with assessing risk to fish

7.10.4.1 Measurement endpoint A: compare surface water EPC to benchmarks

See Section 7.10.2.1.

7.10.4.2 Measurement endpoint B: surface water toxicity testing

The fish species used in the toxicity test was exposed according to EPA-recognized standard protocols. The relatively short duration of the test (7 days) increased the uncertainty surrounding the lack of observed toxicity for most samples. Using longer exposures and measuring reproductive output as an additional endpoint might have detected toxicity, which the shorter exposures may have been unable to do. On the other hand, the test used a sensitive life stage (neonates less than 24 hrs old), which increased the chances of detecting short-term toxicity if it had been present.

7.10.4.3 Measurement endpoint C: compare measured fish tissue residue levels to CBRs

Uncertainties in the CBR evaluation for fish are similar to those described for invertebrates. There is uncertainty in the extrapolation from species on which CBRs are based and species occurring in the ponds.

7.10.5 Uncertainties associated with assessing risk to birds and mammals

The sediment uptake assumption for the raccoon (9% of the diet) was taken from EPA (1993). Because the value was based on conditions different from those in the ponds, there is uncertainty in the accuracy of this value for Grove Pond and Plow Shop raccoons, or other omnivorous mammals. This uncertainty is particularly important because the unacceptable risk concluded for the raccoon in Plow Shop Pond is due to incidental ingestion of arsenic in sediment. Therefore, the risk assumption relies entirely on the sediment intake assumption for this species.

The sediment uptake assumption for the black-crowned night heron (2% of the diet) was based on a best professional judgment. There were no measured values for similar species that could have been used with more confidence; EPA (1993) lists an uptake for other aquatic birds at 2%. This uncertainty is particularly important because the unacceptable risk concluded for the black-crowned night heron in both ponds is due to incidental ingestion of chromium in sediment. Therefore, the risk assumption relies entirely on the sediment intake assumption for this species.

Uncertainty is associated with the sediment ingestion rates for another reason. The estimated sediment uptake percentages are potentially overestimated because of the dense vegetative mat that exists throughout the ponds. Because this mat may act as a barrier between sediment and biota, wildlife receptors may have limited direct exposure to sediment substrate. The incidental ingestion assumptions (e.g., 0.09 for the raccoon and 0.02 for the black-crowned night heron potentially overestimate risk from this pathway.

Grove Pond and Plow Shop Pond wildlife receptors were assumed to forage only within their respective ponds. It is possible that some receptors forage in other areas, such as along Nonacoicus Brook, Cold Spring, or in upland areas, EPC in these areas are not known and cannot be assumed equal to zero. Therefore, Area Use Factors (AUF) were assumed equal to one. The uncertainty associated with the intensity and duration of forage within the ponds may lead to an overestimation of risk in the ponds.

Some of the exposure parameters used for the five wildlife receptors bring uncertainty into the risk assessment. They are not species-specific in all cases and are often based on laboratory or field conditions that are not the same as the conditions experienced by wildlife species in Grove Pond and Plow Shop Pond. Some of the specific concerns regarding the wildlife exposure parameters are the following:

There are uncertainties associated with the EPCs for biota used in the food chain models. For a many chemicals, biota EPCs were measured directly. For those chemicals for which the biota EPC were not measured directly, the EPA was estimated using a literature-derived BSAF. There is uncertainty associated with these values, as they were derived using biota that do not necessarily reflect the biota in Grove Pond and Plow Shop Pond. Further, literature BSAF were derived under conditions in which factors that affect bioaccumulation would differ from conditions in the sediments in grove Pond and Plow Shop Pond. The greatest uncertainties are for chemicals (e.g., antimony and thallium) for which the literature did not provide a chemical-specific BSAF but rather a generic value. These BSAF are thought to be overly conservative and probably result in unrealistically high HQs.

While thallium and antimony HQs suggested potential risk for the black-crowned night heron, the risk calculation as based entirely on the concentration of thallium and antimony sediment. The primary routes of uptake for the night heron for both antimony and thallium are ingestion of invertebrates and frogs. The EPC in both of these dietary items were not established from a direct measurement but estimated, rather, from the sediment concentration and an assumed BSAF of 1. It is likely that this BSAF is an overestimate for both of these metals. This is evidenced by the fact that neither antimony nor arsenic were detected in any of the fish samples analyzed.

Only a limited number of metals were included in the analysis of tree swallow stomach contents. Hazard quotients were calculated for these chemicals only. Overall risk to tree swallows may also be influenced by chemicals not included in the analysis. This uncertainty may result in an underestimation of risk to the swallow.

There is inherent uncertainty in the derivation of toxicity benchmarks for ecological receptors for several reasons, including:

- Extrapolation from laboratory to field conditions is uncertain.

- Extrapolation from laboratory test organisms to the representative species in the ponds is uncertain as species differ with respect to their capacities for absorption, metabolism, distribution, and excretion of chemicals, and differing sensitivities to effects. It is not clear if this uncertainty leads to an underestimation or overestimation of risk.

- Extrapolation is required from the form of chemical used in laboratory toxicity tests to field conditions, where different chemical forms likely occur. One important example is aluminum. As discussed in Section 7.5.1.4, aluminum probably exists in sediment in a chemical form that is different, and less toxic than that used in toxicity tests. These differences between chemical forms in the lab and in the two ponds result in uncertainty in the HQ estimates. The direction of the uncertainty is generally unknown.

- There are uncertainties associated with estimates of dietary proportions for wildlife receptors. An effort was made to use literature values (USEPA 1993), as available, but literature values did not always match dietary items for which site-specific data were available (e.g. swallow egg data). Therefore, profession judgment was used to estimate the proportion of diet consisting of items not specifically addressed in the literature. These uncertainties my lead to an underestimation or overestimation of risk.

7.10.6 Background and Residual Risk Evaluation

The background/residual risk evaluation was based on Flannagan Pond data only. There is, therefore, uncertainty associated with the small number of samples used to derive background EPCs. For fish, three samples from Flannagan Pond were used to derive the background EPCs. Regional background data for mercury in fish are also available in MADEP (2003). Regional concentrations of mercury in fish in northeastern Massachusetts were comparable to concentrations in Flannagan Pond. Regional concentrations in largemouth bass ranged from 0.18 - 2.5 mg/kg, with a mean of 0.89. The mercury concentrations in largemouth bass in the ponds ranged from 0.07 - 1.14 mg/kg, with a mean of 0.21 mg/kg, in Grove Pond and 0.65 to 2.7 mg/kg, with a mean of 1.38 mg/kg in Plow Shop Pond. Regional concentrations in brown bullhead ranged from 0.10 - 0.52 mg/kg, with a mean of 0.28. The mercury concentrations in brown bullhead in the ponds ranged from ND - 0.035 mg/kg, with a mean of 0.020 mg/kg, in Grove Pond and ranged from 0.09 to 0.4 mg/kg, with a mean of 0.28 mg/kg in Plow Shop Pond. Regional concentrations in yellow perch ranged from 0.12-1.1, with a mean of 0.44.

These results are interesting in that they provide qualitative evidence that concentrations in Grove Pond and Plow Shop Pond are comparable to regional fish tissue concentrations. The MADEP (2003) regional data were not incorporated into the mercury EPCs for background, however. This is primarily because they were measured in lateral muscle tissue and not whole body. While most methylmercury in fish is sequestered in lateral muscle, using data from this tissue alone probably overestimates the whole body concentration to a degree. The Flannagan Pond fish concentrations are for whole body and are lower than the regional concentrations. Using the Flannagan Pond data alone, therefore, provides a more conservative estimate of background concentrations; i.e., a lower background concentration for comparison with site concentrations.

Background EPC for non-fish biota were based on BSAF derived from sediment and biota in Grove Pond and Plow Shop Pond. Because the BSAF were derived from data that were not spatially coordinated, factors that affect bioaccumulation in a given specific location are not reflected in the BSAF. For example, for arsenic, one of the two derived BSAF for invertebrates in Plow Shop Pond was based on a maximum concentration in sediment of 6800 mg/kg and maximum concentration in aquatic invertebrates of 2.45 mg/kg (Table G-2). The invertebrate sample was actually collected in a different location, with an unknown sediment concentration. While there is uncertainty in this method, it was used in order to not overestimate risk to background receptors and is more conservative than using higher literature BSAFs.

CHAPTER 8: SUMMARY AND CONCLUSIONS

Grove Pond and Plow Shop have very high concentrations of some chemicals, particularly metals, in sediment. This BERA demonstrates that while potential unacceptable risk from exposure to a small number of COC in Grove Pond and Plow Shop Pond media exists for some wildlife and benthic receptors, the high concentrations in sediment do not equate to unacceptable ecological risk for most chemicals. The very high concentrations in sediments are not reflected in aquatic organisms and it is likely that, along with the other factors discussed in the preceding text, the thick vegetative mat in both ponds acts as a barrier between chemicals in sediments and the aquatic biological community.

The conclusions of the BERA for each receptor are summarized in Table 61 (Grove Pond) and 62 (Plow Shop Pond) and discussed in the following sections.

8.1 WATER COLUMN INVERTEBRATES

The potential risks to water column invertebrate populations was assessed with two measurement endpoints:

1. Comparison of site surface water EPC with literature benchmarks.
2. Surface water chronic toxicity testing.

8.1.1 Grove Pond

The benchmark comparisons with surface water data suggested low risk to water column invertebrates. The surface water toxicity testing revealed no risk to aquatic invertebrates. No unacceptable risk is concluded for the surface water invertebrate community in Grove Pond.

8.1.2 Plow Shop Pond

The benchmark comparisons with surface water data suggested low risk to water column invertebrates. The surface water toxicity testing revealed no risk to aquatic invertebrates. No unacceptable risk is concluded for the surface water invertebrate community in Plow Shop Pond.

8.2 BENTHIC MACROINVERTEBRATE COMMUNITY

The potential risks to benthic macroinvertebrate communities was assessed with three measurement endpoints:

1. Comparison of sediment EPC to sediment benchmarks.
2. Sediment toxicity testing.
3. Comparison of aquatic invertebrate tissue concentrations with CBRs.

8.2.1 Grove Pond

The benchmark comparisons with sediment data suggested high risk to benthic invertebrates. The results of the toxicity tests and CBR evaluation, however, which carried greater Weights of Evidence, suggested low risk to the benthos. No unacceptable risk is concluded for the benthic invertebrate community in Grove Pond.

8.2.2 Plow Shop Pond

The benchmark comparisons with sediment data suggested high risk to benthic invertebrates. Toxicity test results indicate that PAHs in the vicinity of the Railroad Roundhouse pose unacceptable risk to benthic invertebrates. Further, potential unacceptable risk was determined for benthic invertebrates along the western shoreline, including Red Cove, from a small number of chemicals (arsenic, iron, and manganese, and possibly mercury). The results of the CBR evaluation, however, suggested low risk to the benthos. Unacceptable risk was concluded for benthic invertebrates in the locations listed above but not throughout the pond.

8.3 WARM WATER FISH COMMUNITY

The potential risks to fish communities was assessed with three measurement endpoints:

1. Comparison of site surface water EPC with literature benchmarks.
2. Surface water chronic toxicity testing.
3. Comparison of fish tissue residue levels against fish CBRs.

8.3.1 Grove Pond

The benchmark comparisons with surface water data suggested low risk to fish. In addition, the surface water toxicity testing revealed no risk. Finally, the comparison with CBRs suggested low risk to fish. No unacceptable risk is concluded for the fish community in Grove Pond.

8.3.2 Plow Shop Pond

The benchmark comparisons with surface water data suggested low risk to fish. In addition, the surface water toxicity testing revealed no risk. Finally, the comparison with CBRs suggested low risk to fish. No unacceptable risk is concluded for the fish community in Plow Shop Pond.

8.4 OMNIVOROUS MAMMAL POPULATIONS

The potential risks to omnivorous mammals, represented by the raccoon, were assessed with one measurement endpoint: the calculation of an HQ.

8.4.1 Grove Pond

The food chain modeling suggested no unacceptable risk to omnivorous mammals foraging in Grove Pond.

8.4.2 Plow Shop Pond

The food chain modeling suggested potential unacceptable risk to omnivorous mammals from ingestion of arsenic in Plow Shop Pond sediment. There is significant uncertainty associated with this conclusion, however, because risk is based on incidental ingestion of sediment and an estimated sediment ingestion rate, as discussed in Section 7.10. No unacceptable risk for this receptor was found for any other COPC in Plow Shop Pond.

8.5 PISCIVOROUS MAMMAL POPULATIONS

The potential risks to piscivorous mammals, represented by the mink, were assessed with one measurement endpoint: the calculation of an HQ.

8.5.1 Grove Pond

The food chain modeling suggested no unacceptable risk to piscivorous mammals foraging in Grove Pond.

8.5.2 Plow Shop Pond

The food chain modeling suggested no unacceptable risk to piscivorous mammals foraging in Plow Shop Pond.

8.6 CARNIVOROUS BIRD POPULATION

The potential risks to carnivorous birds, represented by the black-crowned night heron, were assessed with one measurement endpoint: the calculation of an HQ.

8.6.1 Grove Pond

The food chain modeling suggested potential unacceptable risk to carnivorous birds from ingestion of chromium in Grove Pond sediment. There is significant uncertainty associated with this conclusion, however, because risk is based on incidental ingestion of sediment and an estimated sediment ingestion rate, as discussed in Section 7.10. No unacceptable risk for this receptor was found for any other COPC in Grove Pond.

8.6.2 Plow Shop Pond

The food chain modeling suggested potential unacceptable risk to carnivorous birds from ingestion of chromium in Plow Shop Pond sediment. There is significant uncertainty associated with this conclusion, however, because risk is based on incidental ingestion of sediment and an estimated sediment ingestion rate, as discussed in Section 7.10. No unacceptable risk for this receptor was found for any other COPC in Plow Shop Pond.

8.7 PISCIVOROUS BIRD POPULATIONS

The potential risks to piscivorous birds, represented by the belted kingfisher, were assessed with one measurement endpoint: the calculation of an HQ.

8.7.1 Grove Pond

The food chain modeling suggested no unacceptable risk to piscivorous birds foraging in Grove Pond.

8.7.2 Plow Shop Pond

The food chain modeling suggested potential unacceptable risk to piscivorous birds from ingestion of mercury in Plow Shop Pond fish. No unacceptable risk for this receptor was found for any other COPC in Plow Shop Pond.

8.8 INSECTIVOROUS BIRD POPULATIONS

The potential risks to insectivorous birds, represented by the tree swallow, were assessed with one measurement endpoint: the calculation of an HQ.

8.8.1 Grove Pond

The food chain modeling suggested no unacceptable risk to insectivorous birds foraging in Grove Pond.

8.8.2 Plow Shop Pond

The food chain modeling suggested no unacceptable risk to insectivorous birds foraging in Plow Shop Pond.

CHAPTER 9.0 REFERENCES

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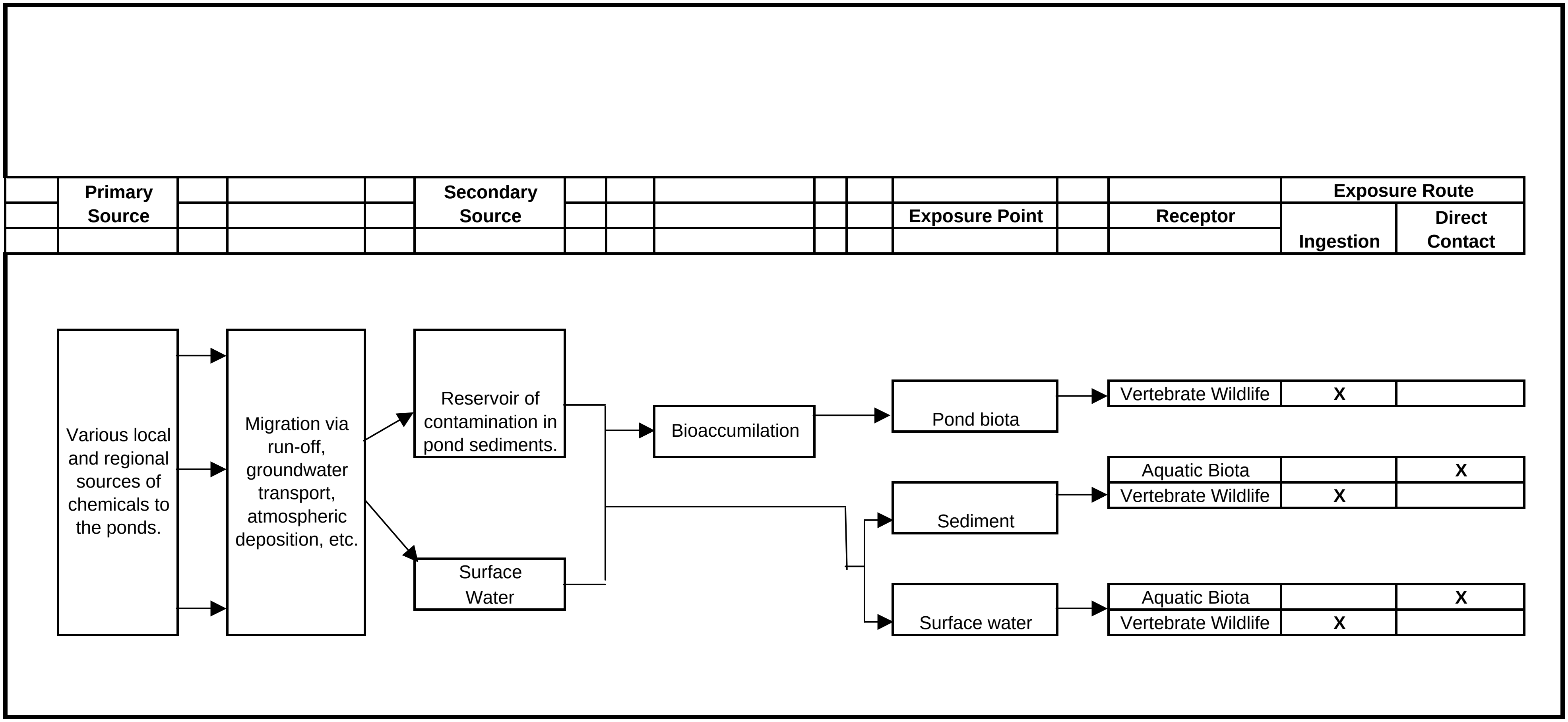
Figures

FIGURE 1
Conceptual Site Model for Ecological Exposures in Grove Pond and Plow Shop Pond



Note: X = Evaluated in BERA.

Tables

TABLE 1
Analytical Data used in BERA - Grove Pond

		Chemicals Analyzed				
Collection Date (on or before)	No. of Samples Collected	Metals	Pest/PCBs	SVOC	VOC	Reference
Surface Water Samples						
12/22/1993	4	Dissolved metals				ABB-ES(1993)
8/25/1998	6	Dissolved metals				GF (1999)
2/24/1999	1	Dissolved metals				GF (1999)
11/18/1999	2	Dissolved metals				PDC (2000)
2/17/2000	1	Dissolved metals				GF (2000)
11/3/2004	6	Dissolved metals				EPA (2005)
Total	20					
Oct-92	7	Total metals				M&E (1994)
Apr-95	6	Total metals				ABB-ES 1995
8/25/1998	8	Total metals				GF (1999)
8/12/1999	2	Total metals				PDC (2000)
11/18/1999	2	Total metals				PDC (2000)
11/3/2004	6	Total metals				EPA (2005)
Total	31					
Sediment Samples						
Jan-92	4	Metals				ERM (1994)
Jan-92	5	Metals				ABB-ES(1993)
Jan-92	6	Metals				M&E (1994)
Oct-92	7	Metals	Pest/PCBs	PAHs	VOCs	M&E (1994)
Dec-93	7	Metals	Pest/PCBs	PAHs	VOCs	ABB-ES(1993)
Apr-95	48	Metals	Pest/PCBs	PAHs		ABB-ES (1995)
Apr-95	15	Metals	Pest/PCBs			ABB-ES (1995)
9/11/1998	4	Metals				EPA (1999)
8/1/1999	10	Metals				GF (2002)
8/1/1999	10	Metals				GF (1999)
9/1/2000	3	Metals				Norton (2001)
1/1/2001	10	Metals				Haines and Longcore (2001)
3/1/2004	15	Metals				EPA (2005)
2/2/2005	3	Metals	Pest/PCBs	PAHs		EPA (2005)
4/29/1994	7		Pest/PCBs	PAHs	VOCs	M&E (1994)
Total	154					
Biological Tissue						
1992 (Fish - whole body)	28	metals	Pest/PCBs			1992 Fish Data from Mierzykowski et al. (1993)
2004 (Fish - whole body)	4	metals	Pest/PCBs			June 30, 2004 Fish Data from EPA
1998 (crayfish)	3	metals				Mierzykowski and Carr (September 2000)
2000 (crayfish)	3 (composites)	metals				Haines and Longcore (2001)
2001 (odonata)	4 (composites)	metals				Haines and Longcore (2001)
July 1999 (frog)	25	metals				EPA (2001)
1998 (swallow eggs)	6	limited metals				Haines and Longcore (2001)
1999 (swallow eggs)	14	limited metals				Haines and Longcore (2001)
1999 (swallow stomach contents)	10	limited metals				Haines and Longcore (2001)
Total	97					

TABLE 2
Analytical Data used in BERA - Plow Shop Pond

Collection Date (on or before)	No. of Samples Collected	Chemicals Analyzed: Metals	Pestcides/PCBs	SVOC	VOC	Reference
Surface Water Samples						
11/3/2004	6	Dissolved metals				EPA (2005)
11/19/2004	4	Dissolved metals				EPA (2005)
Total	10					
1/1/1991	13	Total metals				ABB-ES (1993)
9/11/1998	2	Total metals				EPA (1999)
9/11/1998	4	Total metals				EPA (1999)
11/19/2004	4	Total metals				EPA (2005)
7/16/2004	1	Total metals				EPA (2005)
11/3/2004	6	Total metals				EPA (2005)
Total	30					
Sediment Samples						
1/1/1991	13	metals	Pestcides/PCBs	PAHs	VOC	ABB-ES (1993)
1/1/1992	32	metals	Pestcides/PCBs			ABB-ES (1993)
1/1/1994	4	metals		PAHs		ABB-ES (1995)
4/1/1995	22	metals				ABB-ES (1995)
9/11/1998	3	metals				EPA (1999)
July 26&28, 1999	3	metals				Norton (2001)
1/1/2001	10	metals				Haines and Longcore (2001)
Mar-04	28	metals				EPA (2005)
2/1/2005	11	metals	Pestcides/PCBs	PAHs		EPA (2005)
Total	126					
Biological Tissue						
1992 (fish - whole body)	15	metals	Pestcides/PCBs			ABB (1993)
2004 (fish - whole body)	4	metals	Pestcides/PCBs			EPA 2004 Fish LIMs Data
1998 (mussels)	6	metals				Mierzykowski and Carr (2000)
1998 (crayfish)	1	metals				Mierzykowski and Carr (2000)
2000 (crayfish)	4	metals				Haines and Longcore (2001)
2000 (odonata)	4	metals				Haines and Longcore (2001)
1999 (frog)	13	metals				EPA (2001)
1998 (swallow egg)	4	select metals				Haines and Longcore (2001)
1999 (swallow egg)	9	select metals				Haines and Longcore (2001)
1999 (swallow stomach contents)	3	select metals				Haines and Longcore (2001)
Total	62					

TABLE 3
Selection of COPC in Grove Pond Surface Water

Chemical	Maximum Concentration (ug/L)	Chronic benchmark (ug/L)	Source	Notes	COPC?
Inorganics[a,b]					
Aluminum	**176**	87	EPA (2002)	c	**Y**
Antimony	ND	30	Suter and Tsao(1996)		N
Arsenic	4	150	EPA (2002)		N
Barium	**21**	4	Suter and Tsao(1996)		**Y**
Beryllium	ND	0.66	Suter and Tsao(1996)		N
Cadmium	ND	0.14	EPA (2002)	d	N
Calcium	27000	116000	Suter and Tsao(1996)		N
Chromium	4	11	EPA (2002)	e	N
Cobalt	4	23	Suter and Tsao(1996)		N
Copper	2	4.3	EPA (2002)	d	N
Iron	350	1000	EPA (2002)		N
Lead	0.39	1	EPA (2002)	d	N
Magnesium	3100	82000	Suter and Tsao(1996)		N
Manganese	**801**	120	Suter and Tsao(1996)		**Y**
Mercury	ND	0.77	EPA (2002)		N
Nickel	1	25	EPA (2002)	d	N
Potassium	780	53000	Suter and Tsao(1996)		N
Selenium	ND	5	EPA (2002)		N
Silver	ND	0.74	EPA (2002)	d	N
Sodium	22000	680000	Suter and Tsao(1996)		N
Thallium	ND	12	Suter and Tsao(1996)		N
Vanadium	ND	20	Suter and Tsao(1996)		N
Zinc	20	57	EPA (2002)	d	N

Bold indicates an exceedance of the chronic benchmark

a. No organic chemicals were detected in any of the Grove Pond surface water samples used for this ecological risk assessment.

b. Concentrations of dissolved inorganics in surface water. The only exception is the concentration of aluminum and benchmark are for total aluminum, not dissolved.

c. For total recoverable aluminum in surface water.

d. Benchmarks normalized to Grove Pond water hardness average of 42.4 mg/L.

e. Values are those for Chromium (VI).

TABLE 4
Selection of COPC in Plow Shop Pond Surface Water

Chemical	Maximum Concentration (ug/L)	Chronic benchmark (ug/L)	Source	Notes	COPC?
Inorganics[a,b]					
Aluminum	**225**	87	EPA (2002)	c	**Y**
Antimony	ND	30	Suter and Tsao(1996)		N
Arsenic	9.7	150	EPA (2002)		N
Barium	**26**	4	Suter and Tsao(1996)		**Y**
Beryllium	ND	0.66	Suter and Tsao(1996)		N
Cadmium	ND	0.14	EPA (2002)		N
Calcium	11000	116000	Suter and Tsao(1996)		N
Chromium	ND	11	EPA (2002)		N
Cobalt	13	23	Suter and Tsao(1996)		N
Copper	3.2	3.4	EPA (2002)	d	N
Iron	**2900**	1000	EPA (2002)		N
Lead	0.23	0.72	EPA (2002)	d	N
Magnesium	2200	82000	Suter and Tsao(1996)		N
Manganese	**390**	120	Suter and Tsao(1996)		**Y**
Mercury	ND	0.77	EPA (2002)		N
Nickel	2.9	19.9	EPA (2002)	d	N
Potassium	NA	53000	Suter and Tsao(1996)		N
Selenium	**20**	5	EPA (2002)	e	**Y**
Silver	ND	0.74	EPA (2002)		N
Sodium	NA	680000	Suter and Tsao(1996)		N
Thallium	ND	12	Suter and Tsao(1996)		N
Vanadium	ND	20	Suter and Tsao(1996)		N
Zinc	11	44.9	EPA (2002)	d	N

Bold indicates an exceedance of the chronic benchmark

a. No organic chemicals were detected in any of the Plow Shop Pond surface water samples used for this ecological risk assessment.
b. Concentrations of dissolved inorganics in surface water. The only exceptions are the site concentrations and benchmarks for aluminum and selenium, which are total, not dissolved, concetrations.
c. For total recoverable aluminum in surface water.
d. Benchmarks normalized to Plow Shop Pond water hardness average of 32.2 mg/L.
e. For total recoverable selenium in surface water.

TABLE 5
Selection of COPC in Grove Pond Sediment

Inorganics	**Maximum concentration (mg/kg)**	**Chronic (low effect) Screening Value (mg/kg)**	**Source**	**COPEC?**
Aluminum	**90000**	25500	SQRT TEL	Y
Antimony	**41**	2	ER-L	Y
Arsenic	**910**	9.79	TEC	Y
Barium	**470**	0.7	SQRT Bkg	Y
Beryllium	14.1	NA		Y
Cadmium	**730**	0.99	TEC	Y
Calcium	340000	NA		N[a]
Chromium	**52000**	43.4	TEC	Y
Cobalt	**70.0**	10	SQRT Bkg	Y
Copper	**13000**	31.6	TEC	Y
Iron	**42800**	20000	LEL	N[a]
Lead	**1760**	35.8	TEC	Y
Magnesium	5300	NA		N[a]
Manganese	**2500**	460	LEL	Y
Mercury	**422**	0.18	TEC	Y
Methyl mercury	0.07044	NA		Y
Nickel	**86**	22.7	TEC	Y
Potassium	4120	NA		N[a]
Selenium	**41.2**	0.29	SQRT Bkg	Y
Silver	**12.4**	1	ER-L	Y
Sodium	7020	NA		N[a]
Thallium	82.4	NA		Y
Vanadium	**140**	50	SQRT Bkg	Y
Zinc	**820**	121	TEC	Y
Pesticides				
4,4'-DDD	**2.5**	0.00488	TEC	Y
4,4'-DDE	**0.98**	0.00316	TEC	Y
4,4'-DDT	**3.3**	0.00416	TEC	Y
Endrin	**0.028**	0.00222	TEC	Y
SVOC				
1-Methylnaphthalene	1.1	1.3	Other[b]	N
2-Methylnaphthalene	**4**	6.50E-02	ER-L	Y
4-Bromophenyl phenyl ether	1.7	13	SQB c	N
4-Chlorophenyl phenyl ether	0.84	NA		Y
Acenaphthene	0.068	6.2	SQC[d]	N
Acenaphthylene	**0.22**	0.044	ER-L	Y
Anthracene	**2.4**	0.0572	TEC	Y
Benzo(a)anthracene	**3.4**	0.108	TEC	Y
Benzo(a)pyrene	**1.1**	0.15	TEC	Y
Benzo(b)fluoranthene	**2.4**	0.24	LEL[e]	Y
Benzo(ghi)perylene	**1.4**	0.17	LEL	Y
Benzo(k)fluoranthene	**4.9**	0.24	LEL	Y
Bis(2-ethylhexyl)phthalate	0.41	8900	Other[b]	N
Butyl benzyl phthalate	3	110	SQB[c]	N
Chrysene	**3.7**	0.166	TEC	Y
Dibenzo(a,h)anthracene	**0.3**	0.033	TEC	Y
Dibenzofuran	0.7	20	SQB[c]	N
Di-n-butyl phthalate	8	110	SQB[c]	N
Fluoranthene	**7.1**	0.423	TEC	Y
Fluorene	**1.1**	0.0774	TEC	Y
Indeno(1,2,3-cd)pyrene	**1.6**	0.2	LEL	Y
Naphthalene	**20**	0.176	TEC	Y
Phenanthrene	**4.6**	0.204	TEC	Y
Pyrene	**6.4**	0.195	TEC	Y
Total PAH	**42.01**	1.61	TEC	Y
VOC				
Toluene	0.0042	6.7	SQB[c]	N
Xylene (total)	0.0164	0.25	SQB[c,d]	N

Bold indicates exceedance of low-effect level benchmark.
NA = No benchmark available

a. Calcium, iron, manganese, potassium, and sodium are not considered COPC because they are essential nutrients.
b. Equilibrium partitioning-derived Secondary Chronic Value assuming 10% TOC.
c. SQB normalized to 10% TOC.
d. SQC normalized to 10% TOC.
e. Used value for benzo(k)fluoranthene as surrogate.
d. SQB is for xylene, m-.

TABLE 6
Selection of COPC in Plow Shop Pond Sediments

Inorganics	Maximum concentration (mg/kg)	Chronic (low effect) Screening Value	Source	COPEC?
Aluminum	**27000**	25500	SQRT TEL	**Y**
Antimony	**30.7**	2	ER-L	**Y**
Arsenic	**6800**	9.79	TEC	**Y**
Barium	**370**	0.7	SQRT Bkg	**Y**
Beryllium	2.72	NA		**Y**
Cadmium	**66**	0.99	TEC	**Y**
Calcium	34000	NA		N[a]
Chromium	**37800**	43.4	TEC	**Y**
Cobalt	**59**	10	SQRT Bkg	**Y**
Copper	**3450**	31.6	TEC	**Y**
Iron	**410000**	20000	LEL	N[a]
Lead	**1214.31**	35.8	TEC	**Y**
Magnesium	8580	NA		N[a]
Manganese	**54800**	460	LEL	**Y**
Mercury (inorganic)	**250**	0.18	TEC	**Y**
Methylmercury	0.08189	NA		**Y**
Nickel	**87.8**	22.7	TEC	**Y**
Potassium	2340	NA		N[a]
Selenium	**14.7**	0.29	SQRT Bkg	**Y**
Silver	**2**	1	ER-L	**Y**
Sodium	5280	NA		N[a]
Thallium	29.4	NA		**Y**
Vanadium	**166**	50	SQRT Bkg	**Y**
Zinc	**1100**	121	TEC	**Y**
Pesticides/PCBs				
4,4'-DDD	**1.8**	0.00488	TEC	**Y**
4,4'-DDE	**1.3**	0.00316	TEC	**Y**
4,4'-DDT	**0.13**	0.00416	TEC	**Y**
Heptachlor	0.092	0.68	Other[b]	N
Aroclor 1242	0.11	1.7	Other[b]	N
Aroclor 1254	**0.13**	0.06	LEL	**Y**
Aroclor 1260	**0.05**	0.005	LEL	**Y**
SVOC				
2-Methylnaphthalene	**2**	6.50E-02	ER-L	**Y**
Acenaphthene	0.4	6.2	SQCd	N
Acenaphthylene	**0.71**	0.044	ER-L	**Y**
Anthracene	**3.4**	0.0572	TEC	**Y**
Benzo(a)anthracene	**7.1**	0.108	TEC	**Y**
Benzo(a)pyrene	**6.5**	0.15	TEC	**Y**
Benzo(b)fluoranthene	**11**	0.24	LELe	**Y**
Benzo(ghi)perylene	**5.2**	0.17	LEL	**Y**
Benzo(k)fluoranthene	**3.7**	0.24	LEL	**Y**
Chrysene	**8.1**	0.166	TEC	**Y**
Dibenzo(a,h)anthracene	**1.3**	0.033	TEC	**Y**
Dibenzofuran	0.8	20	SQB f	N
Fluoranthene	**18**	0.423	TEC	**Y**
Fluorene	**1.9**	0.0774	TEC	**Y**
Indeno(1,2,3-cd)pyrene	**4.5**	0.2	LEL	**Y**
Naphthalene	**2.4**	0.176	TEC	**Y**
Phenanthrene	**10**	0.204	TEC	**Y**
Pyrene	**14**	0.195	TEC	**Y**
PAH (Total)	**98.65**	1.61	TEC	**Y**
VOC				
Acetone	**2.6**	0.087	Other[b]	**Y**
Methyl ethyl ketone	0.13	2.7	Other[b]	N
Methylene chloride	0.12	3.7	Other[b]	N

Bold indicates exceedance of low-effect level benchmark.

a. Calcium, iron, manganese, potassium, and sodium are not considered COPC because they are essential nutrients.
a1. Average of detected values only to avoid unrealistically high average due to a few highly elevated detection limits for thallium.
b. Equilibrium partitioning derived Secondary Chronic Value assuming 10% TOC..
c. SEL normalized to a TOC of 10%, the maximum value recommended in Persaud et al. (1993). The actual average TOC in Plow Shop Pond was 23%.
d. SQC normalized to 10% TOC.
e. Used value for benzo(k)fluoranthene as surrogate.
f. SQB normalized to 10% TOC.

NA = No benchmark available

Table 7: Assessment and Measurement Endpoints for Grove Pond and Plow Shop Pond Wildlife Receptors

Assessment Endpoint	Measurement Endpoint	Data Used
Protect the long-term health of water column invertebrates	Compare surface water contaminant concentrations against surface water benchmarks Assess surface water toxicity using *C. dubia*	Surface water chemistry data Surface water toxicity data
Protect the integrity of the local macroinvertebrate benthic community	Compare sediment contaminant concentrations against sediment benchmarks Compare mussel and crayfish tissue residue levels against target receptor toxicity reference values (CBRs) Assess sediment toxicity using *H. azteca* and *C. tentans*	Sediment analytical data Mussel and crayfish tissue residue data Sediment toxicity data
Protect the long-term health of local fish populations	Compare surface water contaminant concentrations against surface water benchmarks Assess surface water toxicity using *P. promelas* Compare measured fish tissue residue levels against fish CBRs	Surface water chemistry data Fish tissue residue data Surface water toxicity data
Protect the long-term health of local omnivorous mammal populations (represented by the raccoon)	Compare calculated total daily doses against target receptor TRVs	Fish, invertebrate, frog, bird egg, surface water, and sediment analytical data.

Table 7: Assessment and Measurement Endpoints for Grove Pond and Plow Shop Pond Wildlife Receptors

Assessment Endpoint	Measurement Endpoint	Data Used
Protect the long-term health of local piscivorous mammal populations (represented by the mink)	Compare calculated total daily doses against target receptor TRVs	Fish, surface water, and sediment analytical data.
Protect the long-term health of local omnivorous bird populations (represented by the black-crowned night heron)	Compare calculated total daily doses against target receptor TRVs	Fish, invertebrate, and frog tissue residue, and surface water and sediment analytical data.
Protect the long-term health of local piscivorous bird populations (represented by the belted kingfisher)	Compare calculated total daily doses against target receptor TRVs	Fish and surface water analytical data.
Protect the long-term health of local insectivorous bird populations (e.g., swallow)	Compare calculated total daily doses against target receptor TRVs	Insect tissue residue and surface water analytical data to calculate a daily dose

TABLE 8
Weight -of-Evidence (WOE) Documentation

Assessment Endpoints	Measurement Endpoints	Descriptive Score[b]	Numeric Score[c]	Attributes[a]									
				Biological Linkage	Correlation of Stressor/Response	Utility of Measure	Quality of Data	Site-Specificity	Sensitivity	Spatial representativeness	Temporal Representativeness	Quantitativeness	Standard Measure
Protect the long-term health of water column invertebrates	A. Compare surface water contaminant concentrations against surface water benchmarks	L-M	33	2	3	4	7	2	2	2	3	3	5
	B. Assess surface water toxicity using C. dubia	M	56	5	6	6	7	4	6	4	3	6	9
Protect the long-term health of local fish populations	A. Compare surface water contaminant concentrations against surface water benchmarks	L-M	33	2	3	4	7	2	2	2	3	3	5
	B. Assess surface water toxicity using P. promelas	M	56	5	6	6	7	4	6	4	3	6	9
	C. Compare measured fish tissue residue levels against fish CBRs	M-H	73	7	8	8	7	8	5	8	8	7	7
Protect the integrity of the local macroinvertebrate benthic community	A. Compare sediment contaminant concentrations against sediment benchmarks	L-M	33	2	3	4	7	2	2	2	3	3	5
	B. Compare mussel and crayfish tissue residue levels against target receptor toxicity reference values (CBRs)	M-H	73	7	8	8	7	8	5	8	8	7	7
	C. Assess sediment toxicity using H. azteca and C. tentans	M-H	64	6	7	6	7	4	6	5	7	7	9
Protect the long-term health of local omnivorous mammal populations (represented by the raccoon)	Compare calculated total daily doses against target receptor TRVs	M-H	64	7	6	6	6	7	4	7	8	6	7
Protect the long-term health of local piscivorous mammal populations (represented by the mink)	Compare calculated total daily doses against target receptor TRVs	M-H	64	7	6	6	6	7	4	7	8	6	7
Protect the long-term health of local carnivorous bird populations (represented by the black-crowned night heron)	Compare calculated total daily doses against target receptor TRVs	M-H	64	7	6	6	6	7	4	7	8	6	7
Protect the long-term health of local piscivorous bird populations (represented by the belted kingfisher)	Compare calculated total daily doses against target receptor TRVs	M-H	64	7	6	6	6	7	4	7	8	6	7
Protect the long-term health of local insectivorous bird	Compare calculated total daily doses against target receptor TRVs	M-H	64	7	6	6	6	7	4	7	8	6	7

Notes: The assessment and measurement endpoints included in this table are discussed in Section 4.5 of the BERA report

[a] The attributes are discussed in Menzie et al. (1996) who provide the following guidance for attribute scoring:

Biological Linkage: correlation and/or applicability of measurement endpoint with respect to assessment endpoint; linkage based on known biological processes; similarity of effect; target organ, mechanism of action, and level of ecological organization.

Correlation of Stressor/Response: Ability of the endpoint to demonstrate effects from chronic exposure to stressor and to correlate effects with degree of exposure; susceptibility and magnitude of effects.
Utility of Measure: applicability, certainty and scientific basis of measure that is used to judge environmental harm; sensitivity of benchmark in detecting environmental harm.
Quality of Data: extent to which data quality objectives (DQOs) are met.
Site-Specificity: Representativeness of chemical or biological data, environmental media, species, environmental conditions, benchmark (or reference) and habitat types that are used in the measurement endpoint relative to those present at the site.

Sensitivity: The percentage of the total possible variability that the endpoint is able to detect; the ability of the measurement endpoint to detect effects from stressor, rather than from natural or design variability or uncertainty.
Spatial Representativeness: Spatial overlap of study area, measurement or sampling locations, locations of stressors, locations or receptors, and points of potential exposure to those receptors.
Temporal Representativeness: Temporal overlap between the measurement period and the period during which chronic effects would likely to be detected (daily, weekly, seasonally, annually).
Quantitativeness: Results are quantitative/qualitative, subjective/objective, sufficient to test for statistical significance, and extent to which biological significance can be evaluated.
Standard Measure: Method availability; ASTM approval, suitability and applicability to endpoint and site; need for modification of method; relationship to impact assessment, field survey, toxicity test, benchmark, toxicity quotient, or tissue residue analysis methodologies.

[b] The overall score derived for each measurement endpoint is a qualitative measure of its relative importance in characterizing risk at a given assessment endpoint using multiple lines of evidence. The overall score is determined by the *a priori* assignments for the 10 attributes. The scores are defined as follows: Low = 0-33; Medium = 33-67; High = 68-100.

[c] The numeric scores represent the addition of all the individual attribute scores for each measurement endpoint.

TABLE 9
Surface Water Biota Hazard Quotients - Grove Pond

			Benchmark (ug/L)		Hazard Quotients - Max concentration		Hazard Quotients - Avg concentration	
Chemical	**Maximum Concentration (ug/L)**	**Average Concentration (ug/L)**	**(chronic)**	**(acute)**	**Chronic Effects**	**Acute Effects**	**Chronic Effects**	**Acute Effects**
Inorganics								
Aluminum	176	26	87	750	**2.02**	0.23	0.30	0.03
Barium	21	11.49	4	110	**5.25**	0.19	**2.87**	0.10
Manganese	801	212	120	2300	**6.68**	0.35	**1.77**	0.09

TABLE 10
Surface Water Biota Hazard Quotients - Plow Shop Pond

Chemical			**Benchmark (ug/L)**		**Hazard Quotients - Max concentration**		**Hazard Quotients - Avg concentration**	
Inorganics	**Maximum Concentration (ug/L)**	**Average Concentration (ug/L)**	**(chronic)**	**(acute)**	**Chronic Effects**	**Acute Effects**	**Chronic Effects**	**Acute Effects**
Aluminum	**225**	18	87	750	**2.59**	0.30	0.21	0.02
Barium	**26**	**12.6**	4	110	**6.50**	0.24	**3.15**	0.11
Manganese	**390**	**125**	120	2300	**3.25**	0.17	**1.04**	0.05
Selenium	**20**	**5.13**	5	NA	**4.00**	NA	**1.03**	NA

NA indicates benchmark not available; therefore, HQ could not be calculated.

TABLE 11
Benthic Invert Hazard Quotients - Grove Pond

					Hazard Quotients - Max concentration		Hazard Quotients - Avg concentration	
Inorganics	**Maximum concentration (mg/kg)**	**Average concentration (mg/kg)**	**Chronic (low effect) Screening Value**	**Acute (severe effect) Screening Value**	**Chronic Effects**	**Acute Effects**	**Chronic Effects**	**Acute Effects**
Aluminum	90000	10676	25500	NA	**3.53**	NA	0.42	NA
Antimony	41	12	2	25	**21**	**1.64**	**6.01**	0.48
Arsenic	910	79	9.79	33	**93**	**28**	**8.06**	**2.39**
Barium	470	83	0.7	NA	**671**	NA	**118**	NA
Beryllium	14.1	1.17	NA	NA	NA	NA	NA	NA
Cadmium	730	18	0.99	4.98	**737**	**147**	**18**	**3.59**
Chromium	52000	5859	43.4	111	**1198**	**468**	**135**	**53**
Cobalt	70.0	14	10	NA	**7.00**	NA	**1.41**	NA
Copper	13000	146	31.6	149	**411**	**87**	**4.61**	0.98
Lead	1760	263	35.8	128	**49**	**14**	**7.33**	**2.05**
Manganese	2500	597	460	1100	**5.43**	**2.27**	**1.30**	0.54
Mercury	422	22	0.18	1.06	**2344**	**398**	**122**	**21**
Methyl mercury	0.07044	0.021	NA	NA	NA	NA	NA	NA
Nickel	86	29	22.7	48.6	**3.79**	**1.77**	**1.29**	0.60
Selenium	41.2	8	0.29	NA	**142**	NA	**26**	NA
Silver	12.4	3.20	1	3.7	**12**	**3.35**	**3.20**	0.87
Thallium	82.4	12	NA	NA	NA	NA	NA	NA
Vanadium	140	32	50	NA	**2.80**	NA	0.65	NA
Zinc	820	268	121	459	**6.78**	**1.79**	**2.21**	0.58
Pesticides								
4,4'-DDD	2.5	0.32	0.00488	0.028	**512**	**89**	**66**	**11**
4,4'-DDE	0.98	0.12	0.00316	0.0313	**310**	**31**	**38**	**3.89**
4,4'-DDT	3.3	0.092	0.00416	0.0629	**793**	**52**	**22**	**1.46**
Endrin	0.028	0.011	0.00222	0.207	**13**	0.14	**5.13**	0.06
SVOC								
2-Methylnaphthalene	4	0.255	6.50E-02	6.70E-01	**62**	**5.97**	**3.92**	0.38
4-Chlorophenyl phenyl ether	0.84	0.136	NA	NA	NA	NA	NA	NA
Acenaphthylene	0.22	0.146	0.044	0.64	**5.00**	0.34	**3.32**	0.23
Anthracene	2.4	0.188	0.0572	0.845	**42**	**2.84**	**3.29**	0.22
Benzo(a)anthracene	3.4	0.447	0.108	1.05	**31**	**3.24**	**4.14**	0.43
Benzo(a)pyrene	1.1	0.470	0.15	1.45	**7.33**	0.76	**3.14**	0.32
Benzo(b)fluoranthene	2.4	0.442	0.24	134	**10**	0.02	**1.84**	0.00
Benzo(ghi)perylene	1.4	0.448	0.17	32	**8**	0.04	**2.64**	0.01
Benzo(k)fluoranthene	4.9	0.323	0.24	134	**20**	0.04	**1.35**	0.00
Chrysene	3.7	0.405	0.166	1.29	**22**	**2.87**	**2.44**	0.31
Dibenzo(a,h)anthracene	0.3	0.278	0.033	13	**9.09**	0.02	**8.42**	0.02
Fluoranthene	7.1	0.577	0.423	2.23	**17**	**3.18**	**1.36**	0.26
Fluorene	1.1	0.161	0.0774	0.536	**14**	**2.05**	**2.08**	0.30
Indeno(1,2,3-cd)pyrene	1.6	0.545	0.2	32	**8.00**	0.05	**2.72**	0.02
Naphthalene	20	0.753	0.176	0.561	**114**	**36**	**4.28**	**1.34**
Phenanthrene	4.6	0.402	0.204	1.17	**23**	**3.93**	**1.97**	0.34
Pyrene	6.4	0.642	0.195	1.52	**33**	**4.19**	**3.29**	0.42
Total PAH	42.01	5.52	1.61	22.8	**26**	**1.84**	**3.43**	0.24

NA indicates benchmark not available; therefore, HQ could not be calculated.

TABLE 12
Benthic Invert Hazard Quotients - Plow Shop Pond

					Hazard Quotients - Max concentration		Hazard Quotients - Avg concentration	
Inorganics	**Maximum concentration (mg/kg)**	**Average concentration (mg/kg)**	**Chronic (low effect) Screening Value**	**Acute (severe effect) Screening Value**	**Chronic Effects**	**Acute Effects**	**Chronic Effects**	**Acute Effects**
Aluminum	27000	8228	25500	NA	**1.06**	NA	0.32	NA
Antimony	30.7	15	2	25	**15**	**1.23**	**7.56**	0.60
Arsenic	6800	542	9.79	33	**695**	**206**	**55**	**16**
Barium	370	101	0.7	NA	**529**	NA	**144**	NA
Beryllium	2.72	1.42	NA	NA	NA	NA	NA	NA
Cadmium	66	10	0.99	4.98	**67**	**13**	**10**	**2.05**
Chromium	37800	2275	43.4	111	**871**	**341**	**52**	**20**
Cobalt	59	12	10	NA	**5.90**	NA	**1.23**	NA
Copper	3450	123	31.6	149	**109**	**23**	**3.88**	0.82
Lead	1214.31	169	35.8	128	**34**	**9.49**	**4.71**	**1.32**
Manganese	54800	2348	460	1100	**119**	**50**	**5.10**	**2.13**
Mercury (inorganic)	250	27	0.18	1.06	**1389**	**236**	**150**	**25**
Methylmercury	0.08189	0.04	NA	NA	NA	NA	NA	NA
Nickel	87.8	30	22.7	48.6	**3.87**	**1.81**	**1.31**	0.61
Selenium	14.7	14	0.29	NA	**51**	NA	**49**	NA
Silver	2	4.87	1	3.7	**2.00**	0.54	**4.87**	**1.32**
Thallium	29.4	23	NA	NA	NA	NA	NA	NA
Vanadium	166	27	50	NA	**3.32**	NA	0.53	NA
Zinc	1100	199	121	459	**9.09**	**2.40**	**1.64**	0.43
Pesticides/PCBs								
4,4'-DDD	1.8	0.083	0.00488	0.028	**369**	**64**	**17**	**2.97**
4,4'-DDE	1.3	0.061	0.00316	0.0313	**411**	**42**	**19**	**1.95**
4,4'-DDT	0.13	0.012	0.00416	0.0629	**31**	**2.07**	**2.78**	0.18
Aroclor 1254	0.13	0.050	0.06	3.4	**2.17**	0.04	0.83	0.01
Aroclor 1260	0.05	0.043	0.005	2.4	**10**	0.02	**8.55**	0.02
SVOC								
2-Methylnaphthalene	2	1.28	6.50E-02	6.70E-01	**31**	**2.99**	**20**	**1.90**
Acenaphthylene	0.71	0.20	0.044	0.64	**16**	**1.11**	**4.64**	0.32
Anthracene	3.4	0.48	0.0572	0.845	**59**	**4.02**	**8.40**	0.57
Benzo(a)anthracene	7.1	0.70	0.108	1.05	**66**	**6.76**	**6.49**	0.67
Benzo(a)pyrene	6.5	1.24	0.15	1.45	**43**	**4.48**	**8.30**	0.86
Benzo(b)fluoranthene	11	1.93	0.24	134	**46**	0.08	**8.03**	0.01
Benzo(ghi)perylene	5.2	1.20	0.17	32	**31**	0.16	**7.03**	0.04
Benzo(k)fluoranthene	3.7	0.73	0.24	134	**15**	0.03	**3.03**	0.01
Chrysene	8.1	0.94	0.166	1.29	**49**	**6.28**	**5.67**	0.73
Dibenzo(a,h)anthracene	1.3	0.31	0.033	13	**39**	0.10	**9.29**	0.02
Fluoranthene	18	1.71	0.423	2.23	**43**	**8.07**	**4.05**	0.77
Fluorene	1.9	0.30	0.0774	0.536	**25**	**3.54**	**3.87**	0.56
Indeno(1,2,3-cd)pyrene	4.5	1.03	0.2	32	**23**	0.14	**5.14**	0.03
Naphthalene	2.4	0.50	0.176	0.561	**14**	**4.28**	**2.84**	0.89
Phenanthrene	10	1.04	0.204	1.17	**49**	**8.55**	**5.08**	0.89
Pyrene	14	1.66	0.195	1.52	**72**	**9.21**	**8.50**	**1.09**
PAH (Total)	98.65	10.07	1.61	22.8	**61**	**4.33**	**6.25**	0.44
VOC								
Acetone	2.6	0.0105	0.087	NA	**30**	NA	0.12	NA

NA indicates benchmark not available; therefore, HQ could not be calculated.

TABLE 13
Bioaccumulation Factors - Grove Pond

Chemical	BSAF Aquatic Invertebrates[a,b]	Notes	PUF[c]	Notes
Inorganics				
Aluminum	Invert tissue data available		0.004	
Antimony	0.9		0.2	
Arsenic	Invert tissue data available		0.036	
Barium	Invert tissue data available		0.15	
Beryllium	0.9		0.01	
Cadmium	Invert tissue data available		0.364	
Chromium	Invert tissue data available		0.0075	
Cobalt	1	d	1	d
Copper	Invert tissue data available		0.4	
Lead	Invert tissue data available		0.045	
Manganese	Invert tissue data available		1	d
Mercury (inorganic)	Invert tissue data available		0.0375	
Methylmercury	Invert tissue data available		0.137	
Nickel	Invert tissue data available		0.032	
Selenium	Invert tissue data available		0.016	
Silver	0.9		1	d
strontium	Invert tissue data available		1	d
Thallium	0.9		0.004	
Vanadium	1	d	1	d
Zinc	Invert tissue data available		1.2E-12	
Pesticides/PCBs				
4,4'-DDD	0.95	e	0.00937	e
4,4'-DDE	0.95		0.00937	
4,4'-DDT	0.95	e	0.00937	e
Endrin	1	d	4.50E-03	f
Total PCB	0.53	g	0.01	g
SVOC				
Total PAH	1.24		0.02	
4-Chlorophenyl phenyl ether	1	d	1	d

na indicates that either a chemical was not analyzed or the BCF/BSAF was not available.

a. BCFs are from USEPA. 1999b. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities.

b. BCFs are in (Mg COCP/Kg wet tissue)/(mg COPC/kg dry sediment).

c. Plant Uptake Factor (PUF) in (Mg COPC/Kg dry plant tissue)/(mg COPC/Kg dry sediment)

d. Conservative assumption in absence of literature value.

e. Values for DDT and DDT based on value for DDE as surrogate.

f. HAZWRAP (1994) assuming K_{ow} of 5.6 .

g. Value for Total PCB based on value for Aroclor 1254 as surrogate.

Table 14
Bioaccumulation Factors - Plow Shop Pond

Chemical	BSAF Aquatic Invertebrates[a,b]	Notes	PUF[c]	Notes
Inorganics				
Aluminum	Invert tissue data available		0.004	
Antimony	0.9		0.2	
Arsenic	Invert tissue data available		0.036	
Barium	Invert tissue data available		0.15	
Beryllium	0.9		0.01	
Boron	Invert tissue data available		1	d
Cadmium	Invert tissue data available		0.364	
Chromium	Invert tissue data available		0.0075	
Cobalt	1	d	1	d
Copper	Invert tissue data available		0.4	
Lead	Invert tissue data available		0.045	
Manganese	Invert tissue data available		1	d
Mercury (inorganic)	Invert tissue data available		0.0375	
Methylmercury	Invert tissue data available		0.137	
Nickel	Invert tissue data available		0.032	
Selenium	Invert tissue data available		0.016	
Silver	0.9		1	d
strontium	Invert tissue data available		1	d
Thallium	0.9		0.004	
Vanadium	1	d	1	d
Zinc	Invert tissue data available		1.2E-12	
Pesticides/PCBs				
4,4'-DDD	0.95	e	0.00937	e
4,4'-DDE	0.95		0.00937	
4,4'-DDT	0.95	e	0.00937	e
Aroclor 1254	0.53		0.01	
Aroclor 1260	0.53	f	0.01	f
SVOC				
PAH (Total)	1.24		0.02	
VOC				
Acetone	0.05		52	

na indicates that either a chemical was not analyzed or the BCF/BSAF was not available.
a. BCFs are from USEPA. 1999b. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities.
b. BCFs are in (Mg COCP/Kg wet tissue)/(mg COPC/kg dry sediment).
c. Plant Uptake Factor (PUF) in (Mg COPC/Kg dry plant tissue)/(mg COPC/Kg dry sediment)
d. Conservative assumption in absence of literature value.
e. Values for DDT and DDT based on value for DDE as surrogate.
f. Value for Aroclor 1260 based on value for Aroclor 1254 as surrogate.

TABLE 15
Maximum Exposure Point Concentrations - Grove Pond

Chemical	Surface Water (mg/L) [a]	Sediment (mg/kg)	Fish (mg/kg ww)	Aquatic Invertebrates (mg/kg ww)		Frogs (mg/kg ww)		Swallow Eggs (mg/kg ww)		Swallow stomach contents (mg/kg ww)	Plants (mg/kg dw)	Plants (mg/kg ww)[d]
				Measured	Modeled[b]	Measured	Modeled[c]	Measured	Modeled[c]			
Inorganics												
Aluminum	0.176	90000	21	30		108			30		360	43.2
Antimony	ND	12.1	ND	NA	10.89	NA	10.89		10.89		2.42	0.2904
Arsenic	0.128	910	0.133	1.72		0.478		0.95		6.81	32.76	3.9312
Barium	0.023	470	3.68	37.5		13.7			37.5		70.5	8.46
Beryllium	ND	14.1	0.988	NA	12.69	nd			12.69		0.141	0.01692
Cadmium	ND	730	1.023	1.07		0.269		0.53		1.39	265.72	31.8864
Chromium	0.175	52000	1.80	3.54		11.4		0.61		1113	390	46.8
Cobalt	0.004	70.0	ND	NA	70	NA	70		70		70	8.4
Copper	0.032	13000	1.35	25.4		59.2			25.4		5200	624
Lead	0.027	1760	5.024	0.89		2.69		0.47		5.38	79.2	9.504
Manganese	1.04	2500	54	785		70.3			785		2500	300
Mercury (inorganic)	0.0011	422	0.057e	0.051		0.239				0.095f	15.825	1.899
Methylmercury	0.000000251	0.07044	1.087e	0.046		0.243		1.075		0.177f	0.00965028	0.001158034
Nickel	0.032	86	4.847	2.14		21.9			2.14		2.752	0.33024
Selenium	ND	41.2	0.5538	nd		0.644			nd		0.6592	0.079104
Silver	ND	12.4	ND	NA	11.16	NA	11.16		11.16		12.4	1.488
Strontium	NA	NA	48.48	156		30.7			156		NA	NA
Thallium	ND	0.2	ND	NA	0.18	NA	0.18		0.18		0.0008	0.000096
Vanadium	ND	140	0.9226	NA	140	0.308			140		140	16.8
Zinc	9.11	820	42	34.7		73.4			34.7		9.84E-10	1.1808E-10
Pesticides/PCBs												
4,4'-DDD	ND	2.5	0.13	NA	2.375	NA	2.375	NA	2.375		0.023425	0.002811
4,4'-DDE	ND	0.98	0.27	NA	0.931	NA	0.931	NA	0.931		0.0091826	0.001101912
4,4'-DDT	ND	3.3	ND	NA	3.135	NA	3.135	NA	3.135		0.030921	0.00371052
Endrin	ND	0.028	ND	NA	0.028	NA	0.028	NA	0.028		0.000126	0.00001512
Total PCBs	ND	ND	0.47	NA	NA	NA	NA	NA	NA		NA	NA
SVOC												
Total PAH	ND	42.01	NA	NA	52.0924	NA	52.0924	NA	52.0924		0.8402	0.100824
4-Chlorophenyl phenyl ether	ND	0.84	NA	NA	0.84	NA	0.84	NA	0.84		0.84	0.1008

NA indicates chemical was not analyzed in abiotic medium and cannot be estimated in tissue using bioaccumulation factors.
ND indicates chemcial was analyzed for but not detected.
a. Surface water EPC are the higher of dissolved or total concentrations - in contrast to COPC selection which focused mostly on dissolved concentrations.
b. Concentration estimated by multiplying maximum sediment concentration by BSAF in Table [13].
c. Based on invertebrate EPCs in absence of BSAF for amphibians/bird eggs.
d. The plant EPC been converted to wet weight from dry weight by multiplying by (1-%moisture), with % moisture assumed to equal 88%.
e. Based on maximum total Hg concentration and assumption that 95% of total Hg is in MeHg form.
f. Conservative assumption that 65% of total mercury in flying insects is in methyl form, based on average %MeHg of corduliidae samples.

TABLE 16
Average Exposure Point Concentrations - Grove Pond

Chemical	Surface Water (mg/L) [a]	Sediment (mg/kg)	Fish (mg/kg ww)	Aquatic Invertebrates (mg/kg ww)		Frogs (mg/kg ww)		Swallow Eggs (mg/kg ww)		Swallow stomach contents (mg/kg ww)	Plants (mg/kg dw)	Plants (mg/kg ww)[d]
				Measured	Modeled[b]	Measured	Modeled[c]	Measured	Modeled[c]			
Inorganics												
Aluminum	0.04	1.07E+04	6.05	26.7		22			26.7		4.3E+01	5.1E+00
Antimony	ND	1.10E+01	ND	NA	9.90	NA	9.90		9.9		2.2E+00	2.6E-01
Arsenic	0.01	7.89E+01	0.20	0.9		0.14		0.248		1.192	2.8E+00	3.4E-01
Barium	0.01	8.28E+01	1.27	30.5		4.78			30.5		1.2E+01	1.5E+00
Beryllium	ND	1.17E+00	0.07	NA	1.05	ND			1.05		1.2E-02	1.4E-03
Cadmium	ND	1.79E+01	0.12	0.2		0.07		0.079		0.78	6.5E+00	7.8E-01
Chromium	0.01	5.86E+03	0.67	1.2		1.18		0.215		197	4.4E+01	5.3E+00
Cobalt	0.003	1.41E+01	ND	NA	14.10	NA	14.10		14.1		1.4E+01	1.7E+00
Copper	0.01	1.46E+02	0.60	19.0		5.89			19.0		5.8E+01	7.0E+00
Lead	0.01	2.63E+02	0.72	0.4		0.51		0.216		2.46	1.2E+01	1.4E+00
Manganese	0.21	5.97E+02	17.50	719.3		23			719		6.0E+02	7.2E+01
Mercury (inorganic)	0.0004	2.19E+01	0.01d	0.0319		0.072				0.06937f	8.2E-01	9.8E-02
Methylmercury	NA	2.15E-02	0.196d	0.0256		0.080		0.5742		0.12883f	2.9E-03	3.5E-04
Nickel	0.005	2.93E+01	0.39	1.3		2.35			1.26		9.4E-01	1.1E-01
Selenium	ND	7.61E+00	0.34	ND		0.25			ND		1.2E-01	1.5E-02
Silver	ND	3.20E+00	ND	NA	2.88	NA	2.88		2.88		3.2E+00	3.8E-01
Strontium	NA	NA	19.46	140.3		14			140.3		NA	NA
Thallium	ND	1.60E-01	ND	NA	0.14	NA	0.14		0.1		6.4E-04	7.7E-05
Vanadium	ND	3.24E+01	0.12	NA	32.43	0.25			32.4		3.2E+01	3.9E+00
Zinc	0.93	2.68E+02	18.41	28.4		23			28.4		3.2E-10	3.9E-11
Pesticides/PCBs												
4,4'-DDD	ND	3.21E-01	0.040	NA	0.31	NA	0.31	NA	0.31		3.0E-03	3.6E-04
4,4'-DDE	ND	1.22E-01	0.089	NA	0.12	NA	0.12	NA	0.12		1.1E-03	1.4E-04
4,4'-DDT	ND	9.20E-02	ND	NA	0.09	NA	0.09	NA	0.09		8.6E-04	1.0E-04
Endrin	ND	1.14E-02	ND	NA	0.01	NA	0.01	NA	0.01		5.1E-05	6.1E-06
Total PCBs	ND	ND	0.129	NA	NA	NA	NA	NA	NA		NA	NA
SVOC												
Total PAH	ND	5.52E+00	NA	NA	6.85	NA	6.85	NA	6.85		1.1E-01	1.3E-02
4-Chlorophenyl phenyl ether	ND	1.36E-01	NA	NA	0.14	NA	0.14	NA	0.14		1.4E-01	1.6E-02

NA indicates chemical was not analyzed in abiotic medium and cannot be estimated in tissue using bioaccumulation factors.
ND indicates chemcial was analyzed for but not detected.

a. Surface water EPC are the higher of dissolved or total concentrations - in contrast to COPC selection which focused mostly on dissolved concentrations.
b. Concentration estimated by multiplying average sediment concentration by BSAF in Table [13].
c. Based on invertebrate EPCs in absence of BSAF for amphibians/bird eggs.
d. The plant EPC been converted to wet weight from dry weight by multiplying by (1-%moisture), with % moisture assumed to equal 88%.
e. Based on maximum total Hg concentration and assumption that 95% of total Hg is in MeHg form.
f. Conservative assumption that 65% of total mercury in flying insects is in methyl form, based on average %MeHg of corduliidae samples.

TABLE 17
Maximum Exposure Point Concentrations - Plow Shop Pond

				Aquatic Invertebrates (mg/kg ww)		Frogs (mg/kg ww)		Swallow Eggs (mg/kg ww)				
Chemical	Surface Water (mg/L)[a]	Sediment (mg/kg dw)	Fish (mg/kg ww)	Measured	Modeled[b]	Measured	Modeled[c]	Measured	Modeled[c]	Swallow stomach contents (mg/kg ww)	Plants (mg/kg dw)	Plants (mg/kg ww)[d]
Inorganics												
Aluminum	0.225	27000	4.5	2.94		330			2.94		108	12.96
Antimony	0.005	30.7	nd	NA	27.63	NA	27.63		27.63		6.14	0.7368
Arsenic	0.38	6800	1.3	2.45		0.705		0.58	2.45	ND	244.8	29.376
Barium	0.044	370	4.4	95.1		19.7			95.1		55.5	6.66
Beryllium	0.001	2.72	ND	NA	2.448	nd			2.448		0.0272	0.003264
Boron	NA	NA	NA	0.47		NA	0.47		0.47		NA	NA
Cadmium	0.0015	66	0.09	0.62		0.29		ND	0.62	2.99	24.024	2.88288
Chromium	0.003	37800	0.99	3.19		10.8		0.47	3.19	189	283.5	34.02
Cobalt	0.013	59	0.17	NA	59	NA	59		59		59	7.08
Copper	0.0487	3450	1.3	24.4		5.29			24.4		1380	165.6
Lead	0.005	1214.31	0.18	0.47		1.09		0.47	0.47	1.57	54.64395	6.557274
Manganese	0.59	54800	94.7	1042		47.5			1042		54800	6576
Mercury (inorganic)	ND	250	0.135e	0.069		0.201				0.07385f	9.375	1.125
Methylmercury	ND	0.08189	2.565e	0.056		0.224		1.059		0.13715f	0.011219	0.001346
Nickel	0.0442	87.8	0.8	0.27		5.02			0.27		2.8096	0.337152
Selenium	0.02	14.7	0.67	0.18		0.797			0.18		0.2352	0.028224
Silver	0.0036	2	ND	NA	1.8	NA	1.8		1.8		2	0.24
strontium	NA	NA	NA	157		13			157		NA	NA
Thallium	0.02	29.4	nd	NA	26.46	NA	26.46		26.46		0.1176	0.014112
Vanadium	0.0015	166	0.8	NA	166	0.693			166		166	19.92
Zinc	0.0581	1100	29.6	23.3		97.2			23.3		1.32E-09	1.58E-10
Pesticides/PCBs												
4,4'-DDD	ND	1.8	0.11	NA	1.71	NA	1.71		1.71		0.016866	0.002024
4,4'-DDE	ND	1.3	0.38	NA	1.235	NA	1.235		1.235		0.012181	0.001462
4,4'-DDT	ND	0.13	0.014	NA	0.1235	NA	0.1235		0.1235		0.001218	0.000146
Aroclor 1254	ND	0.13	ND	NA	0.0689	NA	0.0689		0.0689		0.0013	0.000156
Aroclor 1260	ND	0.05	0.33	NA	0.0265	NA	0.0265		0.0265		0.0005	0.00006
SVOC												
PAH (Total)	ND	98.65	NA	NA	122.326	NA	122.326		122.326		1.973	0.23676
VOC												
Acetone	ND	2.6	NA	NA	0.13	NA	0.13		0.13		135.2	16.224

NA indicates chemical was not analyzed in abiotic medium and cannot be estimated in tissue using bioaccumulation factors.
ND indicates chemcial was analyzed for but not detected.
a. Surface water EPC are the higher of dissolved or total concentrations - in contrast to COPC selection which focused mostly on dissolved concentrations.
b. Concentration estimated by multiplying maximum sediment concentration by BSAF in Table [14].
c. Based on invertebrate EPCs in absence of BSAF for amphibians/bird eggs.
d. The plant EPC been converted to wet weight from dry weight by multiplying by (1-%moisture), with % moisture assumed to equal 88%.
e. Based on maximum total Hg concentration and assumption that 95% of total Hg is in MeHg form.
f. Conservative assumption that 65% of total mercury in flying insects is in methyl form, based on average %MeHg of corduliidae samples.

TABLE 18
Average Exposure Point Concentrations - Plow Shop Pond

				Aquatic Invertebrates (mg/kg ww)		Frogs (mg/kg ww)		Swallow Eggs (mg/kg ww)				
Chemical	**Surface Water (mg/L) [a]**	**Sediment (mg/kg)**	**Fish (mg/kg ww)**	**Measured**	**Modeled[b]**	**Measured**	**Modeled[c]**	**Measured**	**Modeled[c]**	**Swallow stomach contents (mg/kg ww)**	**Plants (mg/kg dw)**	**Plants (mg/kg ww)[d]**
Inorganics												
Aluminum	1.82E-02	8228	2.06	2.03		74.9			2.03		3.29E+01	3.9E+00
Antimony	1.45E-03	16	ND	NA	14.0	NA	14.0		14.0		3.11E+00	3.7E-01
Arsenic	1.37E-02	542	0.32	1.03		0.3		0.191		ND	1.95E+01	2.3E+00
Barium	1.13E-02	101	1.55	62		7.2			62		1.51E+01	1.8E+00
Beryllium	3.56E-04	1.42	ND	NA	1.27	ND			1.27		1.42E-02	1.7E-03
Boron	NA	NA	NA	0.41		ND			0.41		NA	NA
Cadmium	4.67E-04	10	0.05	0.23		0.1		ND		1.43	3.72E+00	4.5E-01
Chromium	1.52E-03	2275	0.54	1.24		1.6		0.217		117	1.71E+01	2.0E+00
Cobalt	1.94E-03	12	0.09	NA	12.3	NA	12.3		12.3		1.23E+01	1.5E+00
Copper	6.04E-03	123	0.58	4.08		2.6			4.08		4.90E+01	5.9E+00
Lead	1.30E-03	169	0.23	0.17		0.4		0.204		1.25	7.59E+00	9.1E-01
Manganese	1.20E-01	2348	30.16	672		16.8			672		2.35E+03	2.8E+02
Mercury (inorganic)	ND	27	0.031e	0.04		0.1				0.06825f	1.01E+00	1.2E-01
Methylmercury	NA	0.04	0.586e	0.02		0.1		0.615		0.12675f	5.02E-03	6.0E-04
Nickel	6.49E-03	30	0.38	0.15		0.9			0.15		9.49E-01	1.1E-01
Selenium	5.13E-03	14	0.39	0.17		0.4			0.17		2.29E-01	2.8E-02
Silver	6.88E-04	4.87	ND	NA	4.39	NA	4.39		4.39		4.87E+00	5.8E-01
strontium	NA	NA	NA	39		9.6			39		NA	NA
Thallium	4.78E-03	23	ND	NA	21.0	NA	21.0		21.0		9.33E-02	1.1E-02
Vanadium	5.26E-04	27	0.36	NA	26.6	0.3			26.6		2.66E+01	3.2E+00
Zinc	1.12E-02	199	20.02	19.30		31.8			19.3		2.38E-10	2.9E-11
Pesticides/PCBs												
4,4'-DDD	ND	0.083	0.020	NA	0.079	NA	0.079		0.079		7.80E-04	9.4E-05
4,4'-DDE	ND	0.061	0.082	NA	0.058	NA	0.058		0.058		5.71E-04	6.9E-05
4,4'-DDT	ND	0.012	0.006	NA	0.011	NA	0.011		0.011		1.08E-04	1.3E-05
Aroclor 1254	ND	0.050	ND	NA	0.027	NA	0.027		0.027		5.00E-04	6.0E-05
Aroclor 1260	ND	0.043	0.072	NA	0.023	NA	0.023		0.023		4.27E-04	5.1E-05
SVOC												
PAH (Total)	ND	10.07	NA	NA	12.4868	NA	12.4868		12.4868		2.01E-01	2.4E-02
VOC												
Acetone	ND	0.0105	NA	NA	0.0005	NA	0.0005		0.0005		5.46E-01	6.6E-02

NA indicates chemical was not analyzed in abiotic medium and cannot be estimated in tissue using bioaccumulation factors.
ND indicates chemcial was analyzed for but not detected.
a. Surface water EPC are the higher of dissolved or total concentrations - in contrast to COPC selection which focused mostly on dissolved concentrations.
b. Concentration estimated by multiplying average sediment concentration by BSAF in Table [14].
c. Based on invertebrate EPCs in absence of BSAF for amphibians/bird eggs.
d. The plant EPC been converted to wet weight from dry weight by multiplying by (1-%moisture), with % moisture assumed to equal 88%.
e. Based on maximum total Hg concentration and assumption that 95% of total Hg is in MeHg form.
f. Conservative assumption that 65% of total mercury in flying insects is in methyl form, based on average %MeHg of corduliidae samples.

TABLE 19
Exposure Parameters for Selected Receptors

Raccoon							
	Parameter		**Symbol**	**Value**	**Notes**	**Units**	**Reference**
	Body Weight		BW	5.67	a	Kg	USEPA, 1993
	Food Ingestion Rate		FIR	1.43E+00	b	Kg/day	USEPA, 1993
	Percentage of Diet						
		Fish	FI	0.2	c	unitless	
		Invertebrates	IN	0.2	c	unitless	
		Frogs	FR	0.2	c	unitless	
		Eggs	EG	0.2	c	unitless	
		Plants	PL	0.11	c	unitless	USEPA, 1993
		Sediment	SD	0.09		unitless	USEPA, 1993
	Water Ingestion Rate		WIR	0.468		L/d	USEPA, 1993
	Area Use Factor		AUF	1.00	d	unitless	
Mink							
	Parameter		**Symbol**	**Value**	**Notes**	**Units**	**Reference**
	Body Weight		BW	1.40	e	Kg	USEPA, 1993
	Food Ingestion Rate		FIR	1.96E-01	f	Kg/day	USEPA, 1993
	Percentage of Diet						
		Fish	FI	0.99	g	unitless	
		Sediment	SD	0.01		unitless	EPA (1999c)
	Water Ingestion Rate		WIR	0.111	h	L/d	USEPA, 1993
	Area Use Factor		AUF	1.00	d	unitless	
Belted Kingfisher							
	Parameter		**Symbol**	**Value**	**Notes**	**Units**	**Reference**
	Body Weight		BW	0.15	ii	Kg	USEPA, 1993
	Food Ingestion Rate		FIR	7.40E-02	j	Kg/day	USEPA, 1993
	Percentage of Diet						
		Fish	FI	1	k	unitless	USEPA, 1993
	Water Ingestion Rate		WIR	0.0165		L/d	USEPA, 1993
	Area Use Factor		AUF	1.00	d	unitless	
Black-Crowned Night Heron							
	Parameter		**Symbol**	**Value**	**Notes**	**Units**	**Reference**
	Body Weight		BW	0.88		Kg	Dunning (1993)
	Food Ingestion Rate		FIR	2.34E-01	l	Kg/day	USEPA, 1993
	Percentage of Diet						
		Fish	FI	0.33	c	unitless	
		Invertebrates	IN	0.33	c	unitless	
		Frogs	FR	0.33	c	unitless	
		Sediment	SD	0.02		unitless	professional judgement
	Water Ingestion Rate		WIR	0.0396	m	L/d	USEPA, 1993
	Area Use Factor		AUF	1.00	d	unitless	
Tree Swallow							
	Parameter		**Symbol**	**Value**	**Notes**	**Units**	**Reference**
	Body Weight		BW	0.02		Kg	Dunning (1984) as cited in USACOE/USEPA (2003)
	Food Ingestion Rate		FIR	0.0212	N	kg/d	USEPA, 1993
	Percentage of Diet						
		Stomach Contents	ST	1.0	O		
	Area Use Factor		AUF	1.00	d	unitless	

Notes
a. The raccoon body weight is based on the average for adults.
b. The FIR for the raccoon is based on the allometric equation FI (kg/day) = 0.0687 $Wt^{0.822}$ (kg) in EPA (1993) and converted to wet weight

c. Literature values for ecological receptor dietary proportions vary greatly, depending on available food sources. Therefore, to reflect the available food sources in the ponds, the assumed proportions were selected. While herons and raccoons may eat a greater proportion of some items in certain cases, the assumptions were made to represent omnivorous/carnivorous dietary habits.

d. The Area Use Actor (AUF) is assumed equal to one because of the uncertainties associated with regional contaminant concentrations.
e. Value for eastern races.
f. Average for male and female farm raised animals in Michigan study.
g. As the selected representive mammalian piscivore, the diet of the mink is assumed to be 100% fish (minus sediment as 1% of diet).
h. average of values in EPA 1993
ii. Average of adult body weights from three studies presented in (USEPA 1993).
j. Adults, both sexes.
k. As the selected representive avian piscivore, the diet of the kingfisher is assumed to be 100% fish.

l. Converted to Kg/d from the Nagy allometric equation for seabirds: FIR (g/day dry weight) = 0.495*$BW^{0.704}$. Converted to wet weight by assuming 75% moisture in dietary items.
m. Determined using 0.045 g/g-d for great blue heron and black-crowned night heron body weight.

n. Tree swallow ingestion rate derived from the following Nagy allometric equation in EPA (1993) FI (g/day) = 0.398 Wt0.850 (g). Converted to wet weight by assuming 75% mosture in dietary items.

o. It was assumed that stomach contents reflected 100% of dietary intake, including biotic and abiotic food items.

TABLE 20
Critical Body Residues for Invertebrates

CBRs for Crayfish

Chemical	Invert NOAEL (mg/kg ww)	Invert LOAEL (mg/kg ww)	Source NOAEL	Source LOAEL	Level of Confidence
Inorganics					
Aluminum	NA	NA			
Arsenic	1.28	3.84	Jarvinen and Ankley (1999) as cited in Hathaway ERA	Jarvinen and Ankley (1999)	2
Barium	NA	NA			
Boron	NA	NA			
Cadmium	0.9	5.7	Jarvinen and Ankley (1999)	Jarvinen and Ankley (1999)	1
Chromium	1	3.2	Jarvinen and Ankley (1999)	Jarvinen and Ankley (1999)	3
Copper	50	150	Jarvinen and Ankley (1999)	NOAEL*3	1
Lead	6	18	Dillon (1984)	NOAEL*3	1
Manganese	15.5	46.5	Jarvinen and Ankley (1999)	NOAEL*3	4
Mercury	0.328	3.28	LOAEL/10	Jarvinen and Ankley (1999)	4
Nickel	218.6	328.4	Jarvinen and Ankley (1999)	Jarvinen and Ankley (1999)	4
Selenium	NA	NA			
Strontium	NA	NA			
Zinc	12.7	35.2	Jarvinen and Ankley (1999)	Jarvinen and Ankley (1999)	1

CBRs for Mussels

Chemical	Invert NOAEL (mg/kg ww)	Invert LOAEL (mg/kg ww)	Source NOAEL	Source LOAEL	Level of Confidence
Inorganics					
Aluminum	NA	NA			
Arsenic	1.28	3.84	Hathaway ERA	NOAEL*3	4
Barium	NA	NA			
Boron	NA	NA			
Cadmium	8	16	Kraak et al. (1992)	Kraak et al. (1992)	1
Chromium	1	3.2	Hathaway ERA	Hathaway ERA	4
Copper	15	15	Mersch et al. (1996)	Mersch et al. (1996)	1
Lead	7	35	Kraak et al. (19942)	Kraak et al. (1994)	1
Manganese	15.5	46.5	Hathaway ERA	NOAEL*3	3
Mercury	3.4	10.2	Tessier et al. (1996)	NOAEL*3	1
Nickel	218.6	328.4	Hathaway ERA	Hathaway ERA	1
Selenium	0.294	2.94	LOAEL/10	Ingersoll et al. (1990)	4
Strontium	NA	NA			
Zinc	46	80	Kraak at al. (1994)	King et al. (2004)	1

Criteria for selecting the Level of Confidence (LOC)

crayfish:

LOC = 1 if the CBR represented tissue residue data for crayfish (whole body, muscle, other parts).
LOC = 2 if the CBR represented tissue residue data from freshwater crustaceans.
LOC = 3 if the CBR represented residue data from marine crustaceans.
LOC = 4 if the CBR represented tissue residue data from non-crustacean species.

mussels:

LOC = 1 if the CBR represented tissue residue data for mussels.
LOC = 2 if the CBR represented tissue residue data from freshwater mollusks.
LOC = 3 if the CBR represented residue data from marine mollusks.
LOC = 4 if the CBR represented tissue residue data from non-mollusk species.

TABLE 21
Critical Body Residues for Fish

Chemical	Fish NOAEL (mg/kg ww)	Fish LOAEL (mg/kg ww)	Source: NOAEL	Source: LOAEL	Level of Confidence
Inorganics					
Aluminum	8.53	25.59	Jarvinen and Ankley (1999) as cited in Hathaway ERA	NOAEL*3	1
Arsenic	1.8	2.24	Jarvinen and Ankley (1999)	Jarvinen and Ankley (1999)	1
Barium	NA	NA			
Beryllium	NA	NA			
Boron	NA	NA			
Cadmium	0.036	0.35	Jarvinen and Ankley (1999)	Jarvinen and Ankley (1999)	1
Chromium	0.58	1.74	Jarvinen and Ankley (1999)	NOAEL*3	2
Cobalt	NA	NA			
Copper	0.28	0.3	Jarvinen and Ankley (1999)	Jarvinen and Ankley (1999)	2
Lead	0.34	0.4	Jarvinen and Ankley (1999)	Jarvinen and Ankley (1999)	1
Manganese	NA	NA			
Mercury	1.07	10.7	LOAEL/10	Jarvinen and Ankley (1999)	3
Molybdenum	NA	NA			
Nickel	0.82	2.46	Jarvinen and Ankley (1999)	NOAEL*3	2
Selenium	0.8	1.08	Jarvinen and Ankley (1999)	Jarvinen and Ankley (1999)	1
Strontium	NA	NA			
Vanadium	0.7	2.7	Holdway, et al. (1983)	Holdway, et al. (1983)	2
Zinc	34	40	Jarvinen and Ankley (1999)	Jarvinen and Ankley (1999)	1
Pesticides/PCBs					
4,4'-DDD	0.06	0.6	LOAEL/10	Jarvinen, et al. (1977)	3
4,4'-DDE	0.029	0.29	LOAEL/10	Berlin, et al. (1981)	3
4,4'-DDT	0.42	4.3	LOAEL/10	Gakstatter and Weiss (1967)	3
Aroclor 1260[a]	8.2	24.6	Lieb, et al. (1974)	NOAEL*3	3
Total PCBs	10.9	32.7	Hansen, et al. (1976)	NOAEL*3	3

a. CBR is for Aroclor 1254 as a surrogate.

Criteria for selecting the Level of Confidence (LOC)

LOC = 1 if the CBR represented whole body residue data based on chronic (>30 days) exposures, irrespective of fish species.
LOC = 2 if the CBR represented muscle/fillet or carcass residue data based on chronic (>30 days) exposures, irrespective of fish species.

LOC = 3 if the CBR represented whole body, muscle/fillet or carcass residue data based on acute or subchronic (<30 days) exposures, irrespective of fish species.
LOC = 4 if the CBR represented a different analyte, endpoint, or receptor group.

Table 22
Toxicity Reference Values for Mammals

Chemical	Test Species	Endpoint/Effect	NOAEL Derived TRV (mg/kg/day)	LOAEL Derived TRV (mg/kg/day)	NOAEL Source of TRV	LOAEL Source of TRV
Inorganics						
Aluminum	mouse	LOAEL, reproduction	1.93	19.3	Sample, 1996	Sample, 1996
Antimony	mouse		0.125	1.25	Sample, 1996	Sample, 1996
Arsenic	mouse	LOAEL, reproduction	0.126	1.26	Sample, 1996	Sample, 1996
Barium	rat	NOAEL, growth & hypertension	5.1	15.3	Sample, 1996	NOAEL*3
Beryllium	rat	NOAEL, weight and longevity	0.66	1.98	Sample, 1996	NOAEL*3
Boron	rat		28	93.6	Sample, 1996	Sample, 1996
Cadmium	rat	NOAEL, reproduction	1	3	Sample, 1996	NOAEL*3
Chromium[a]	rat	NOAEL, physiological	2737	27370	Sample, 1996	Sample, 1996
Cobalt	Several	Growth and reproduction	7.33	18.9	EPA (2005)[d]	EPA (2005)[e]
Copper	mink	NOAEL, reproduction	11.7	15.4	Sample, 1996	Sample, 1996
Lead	rat	NOAEL, reproduction	8	80	Sample, 1996	Sample, 1996
Manganese	rat		88	284	Sample, 1996	Sample, 1996
Mercury (inorganic)	rat	NOAEL, reproduction	13.2	39.6	Sample, 1996	NOAEL*3
Methylmercury	rat	NOAEL, reproduction	0.032	0.16	Sample, 1996	Sample, 1996
Nickel	rat		40	80	Sample, 1996	Sample, 1996
Selenium	rat		0.2	0.33	Sample, 1996	Sample, 1996
Silver			NA	NA		
strontium	rat		263	789	Sample, 1996	NOAEL*3
Thallium	rat		0.0074	0.074	Sample, 1996	Sample, 1996
Vanadium	rat	LOAEL, reproduction	0.21	2.1	Sample, 1996	Sample, 1996
Zinc	rat	NOAEL, reproduction	160	320	Sample, 1996	Sample, 1996
Pesticides/PCBs						
4,4'-DDD	rat		0.8	4	Sample, 1996	Sample, 1996
4,4'-DDE	rat		0.8	4	Sample, 1996	Sample, 1996
4,4'-DDT	rat		0.8	4	Sample, 1996	Sample, 1996
Endrin	mouse		0.092	0.92	Sample, 1996	Sample, 1996
Aroclor 1254	mink		0.137	0.411	Sample, 1996	NOAEL*3
Aroclor 1260c	mink		0.137	0.411	Sample, 1996	NOAEL*3
Total PCB	mink		0.137	0.411	Sample, 1996	NOAEL*3
SVOC						
Total PAH[b]	mouse	LOAEL, reproduction	1	3	Sample, 1996	NOAEL*3
4-Chlorophenyl phenyl ether	NA					
VOC						
Acetone	rat		10	50	Sample, 1996	Sample, 1996

NA indicates no toxicity data available.
a. TRV is for chromium III, not chromium VI, because chromium Vi is not stable in anoxic sediments and is converted to chromium III.
b. TRV is for benzo(a)pyrene.
c. TRV is for Aroclor 1254.
d. Geometric mean of 10 growth and reproduction studies.
f. Geometric mean of 14 growth and reproduction studies.

TABLE 23
Toxicity Reference Values for Birds

Chemical	Test Species	Endpoint/Effect	NOAEL Derived TRV (mg/kg/day)	LOAEL Derived TRV (mg/kg/day)	NOAEL Source of TRV	LOAEL Source of TRV
Inorganics						
Aluminum	ringed dove	NOAEL, reproduction	109.7	329.1	Sample, 1996	NOAEL*3
Antimony	mouse[d]		0.125	1.25	Sample, 1996	Sample, 1996
Arsenic	mallard duck	NOAEL, mortality	5.14	12.48	Sample, 1996	Sample, 1996
Barium	chicken	NOAEL, mortality	20.8	41.7	Sample, 1996	Sample, 1996
Beryllium	rat[d]	NOAEL, weight and longevity	0.66	1.98	Sample, 1996	NOAEL*3
Boron	mallard duck		28.8	100	Sample, 1996	Sample, 1996
Cadmium	mallard duck	NOAEL, reproduction	1.45	20	Sample, 1996	Sample, 1996
Chromium[a]	black duck	NOAEL, reproduction	1	5	Sample, 1996	Sample, 1996
Cobalt	Several	NOAEL growth	7.61	18.34	EPA (2005)[e]	EPA (2005)[f]
Copper	chicken	NOAEL, growth and mortality	47	61.7	Sample, 1996	Sample, 1996
Lead	Japanese quail	NOAEL, reproduction	1.13	11.3	Sample, 1996	Sample, 1996
Manganese	Japanese quail		997	2991	Sample, 1996	NOAEL*3
Mercury (inorganic)	Japanese quail	NOAEL, reproduction	0.45	0.9	Sample, 1996	Sample, 1996
Methylmercury	mallard duck	LOAEL, reproduction	0.0064	0.064	Sample, 1996	Sample, 1996
Nickel	mallard duckling		77.4	107	Sample, 1996	Sample, 1996
Selenium	black-crowned night heron		1.8	5.4	Sample, 1996	NOAEL*3
Silver			NA	NA		
strontium	rat[d]		263	789	Sample, 1996	NOAEL*3
Thallium	rat[d]		0.0074	0.074	Sample, 1996	Sample, 1996
Vanadium	mallard duck	NOAEL, mortality, body weight and blood chemistry	11.4	34.2	Sample, 1996	NOAEL*3
Zinc	chicken	NOAEL, reproduction	29.5	131	Sample, 1996	Sample, 1996
Pesticides/PCBs						
4,4'-DDD	black duck		0.014	0.14	Sample, 1996	Sample, 1996
4,4'-DDE	black duck		0.014	0.14	Sample, 1996	Sample, 1996
4,4'-DDT	black duck		0.014	0.14	Sample, 1996	Sample, 1996
Endrin	screech owl		0.01	0.1	Sample, 1996	Sample, 1996
Aroclor 1254	ring-necked pheasant		0.18	1.8	Sample, 1996	Sample, 1996
Aroclor 1260c	ring-necked pheasant		0.18	1.8	Sample, 1996	Sample, 1996
Total PCB	ring-necked pheasant		0.18	1.8	Sample, 1996	Sample, 1996
SVOC						
Total PAH[b]	chicken	Subchronic NOAEL, fertility and malformations	40	120	Rigdon and Neal, 1963	NOAEL*3
4-Chlorophenyl phenyl ether	NA		NA	NA		
VOC						
Acetone	Japanese quail	NOAEL, survival	622	1866	Hill and Camardese, 1986	NOAEL*3

NA indicates no toxicity data available.
a. TRV is for Cr III, not Cr VI.
b. TRV is for benzo(a)pyrene.
c. TRV is for Aroclor 1254.
d. In the absence of an avian TRV, the mammalian TRV was used as a surrogate.
e. Geometric mean of 5 growth studies.
f. Geometric mean of 9 growth studies.

TABLE 24
Surface Water Toxicity Test Results Relative to Surface Water Chemistry Data - Grove Pond Invertebrates

	C. dubia							
	Laboratory Control	Flan-Sed-1 (reference)	Grove-SW-1	Grove-SW-2	Grove-SW-3	Grove-SW-4	Grove-SW-5	Grove-SW-6
%Survival	100	100	100	70	100	80	100	90
Reproduction								
Avg # neonates per surviving brood	37	44	45	45	49	49	41	46
% brooders with 3+broods	100	100	90	70	100	80	100	90
Avg # neonates for brooders with 3+ broods	37	44	50	45	49	49	41	46

Bold indicates a statistically significant result

Analytical Results

Grove Pond COPC

Total Recoverable Metals (ug/l)	Benchmark (ug/L) (chronic)	(acute)	Flan-SW-1	Grove-SW-1	Grove-SW-2	Grove-SW-2 (DUP)	Grove-SW-3	Grove-SW-4	Grove-SW-5	Grove-SW-6
Aluminum	87	750	**720** J	19 J	8 J	10 J	48 J	13 J	27 J	18 J
Antimony	30	180	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Arsenic	150	340	5	2.3	4.6	4.6	1.1	1.3	1.4	1.9
Barium	4	110	**17**	**23**	**13**	**13**	**18**	**15**	**14**	**15**
Beryllium	0.66	35	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Cadmium	0.14	0.87	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Calcium	116000	NA	7,100	27,000	21,000	21,000	17,000	12,000	11,000	12,000
Chromium	11	16	2 J	**20**	5 J	5 J	1 J	0.8 J	0.8 J	0.8 J
Cobalt	23	1500	0.72	0.2 ND	0.2 ND	0.2 ND	0.28	0.2 ND	0.3	0.43
Copper	4.3	6	3 J	3 J	2 J	**32**	3 J	1 J	3 J	2 J
Iron	1000	NA	**1800**	390	460 J	500	130	620	650	940
Lead	1	25	**3.5**	**2** J	0.5 J	**3.4**	0.4 J	0.3 J	0.6 J	0.5 J
Magnesium	82000	NA	1,300	3,100	2,500	2,500	2,300	2,200	2,300	2,300
Manganese	120	2300	**310**	**200**	**600**	**610**	57	**210**	**180**	**350**
Total Mercury	0.77	1.4	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Molybdenum	NA	NA	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Nickel	25	227	1.8	1.4	1	1.2	2.5	1.1	1.6	1.3
Selenium	5	NA	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND
Silver	0.74	NA	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Thallium	12	110	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Vanadium	20	280	1.3	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Zinc	57	57	13 J	6 J	5 J	8 J	8 J	8 J	8 J	7 J
Dissolved Metals (ug/l)										
Aluminum	87	750	5 ND	5 ND	5 ND	5 ND	15	5 ND	6.2	6.4
Antimony	30	180	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Arsenic	150	340	0.58	1.7	4	3.9	1.3	0.88	1	1.4
Barium	4	110	**7.6**	**21**	**13**	**13**	**18**	**13**	**12**	**14**
Beryllium	0.66	35	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Cadmium	0.14	0.87	0.2 ND	0.2 ND	0.2 ND	ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Calcium	116000	NA	6,500	27,000	21,000	21,000	16,000	11,000	12,000	12,000
Chromium	11	16	0.5 ND	3.9	2.1	2.1	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Cobalt	23	1500	0.55	0.2 ND	1.1	0.3	0.44	1.7	3.7	4
Copper	4.3	6	1	1.7	0.91	1.4	0.52	0.95	0.66	0.73
Iron	1000	NA	50 ND	160	240	260	58	180	240	350
Lead	1	25	0.2 ND	0.39	0.22	0.24	0.2 ND	0.24	0.2 ND	0.2 ND
Magnesium	82000	NA	1,100	3,100	2,500	2,600	2,200	2,200	2,400	2,400
Manganese	120	2300	6.9	**130**	**540**	**520**	46	50	**120**	**310**
Total Mercury	0.77	1.4	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Molybdenum	NA	NA	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Nickel	25	227	0.51	1.2	0.98	0.91	1.4	1.1	1.3	1.3
Selenium	5	NA	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND
Silver	0.74	NA	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Thallium	12	110	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Vanadium	20	280	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Zinc	57	57	5 ND	5 ND	5 ND	5 ND	5 ND	6.3	5 ND	5 ND

ND = non detected
ND values represent reporting limits

Table 25
Surface Water Toxicity Test Results Relative to Surface Water Chemistry Data - Plow Shop Pond Invertebrates

	C. dubia							
	Laboratory Control	**Flan-Sed-1**	**Plow-SW-1**	**Plow-SW-2**	**Plow-SW-3**	**Plow-SW-4**	**Plow-SW-5**	**Plow-SW-6**
%Survival	60	100	90	90	100	80	90	100
Reproduction								
Avg # neonates per surviving brood	36	42	53	45	50	38	40	47
% brooders with 3+broods	60	90	90	90	100	70	80	100
Avg # neonates for brooders with 3+ broods	36	46	53	45	50	42	44	47

Bold indicates a statistically significant result

Analytical Results

Plow Shop Pond COPC	**Benchmark (ug/L)**								
Total Recoverable Metals (ug/l)	**(chronic)**	**(acute)**	**Flan-SW-1**	**Plow-SW-1**	**Plow-SW-2**	**Plow-SW-3**	**Plow-SW-4**	**Plow-SW-5**	**Plow-SW-6**
Aluminum	87	750	**720** J	12 J	10 J	8 J	16 J	12 J	11 J
Antimony	30	180	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Arsenic	150	340	5	2	1.4	1 ND	1 ND	1 ND	1 ND
Barium	4	110	**17**	**11**	**9.2**	**9.7**	**9.4**	**11**	**11**
Beryllium	0.66	35	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Cadmium	0.14	0.87	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Calcium	116000	NA	7,100	12,000	11,000	10,000	10,000	10,000	10,000
Chromium	11	16	2 J	0.9 J	0.8 J	0.9 J	1	1 J	1 J
Cobalt	23	1500	0.72	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Copper	4.3	6	3 J	2 J	2 J	1 J	3 J	**6** J	2 J
Iron	1000	NA	**1800**	420	280	220	220	260	280
Lead	1	25	**3.5**	0.3 J	0.2 J	0.2 ND	0.4 J	0.3 J	0.4 J
Magnesium	82000	NA	1,300	2,300	2,100	2,000	1,900	2,000	2,000
Manganese	120	2300	**310**	34	16	27	29	91	87
Total Mercury	0.77	1.4	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Molybdenum	NA	NA	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Nickel	25	227	1.8	1	0.91	0.8	1.4	0.85	0.94
Selenium	5	NA	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND
Silver	0.74	NA	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Thallium	12	110	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Vanadium	20	280	1.3	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Zinc	57	57	13 J	3 J	9 J	4 J	6 J	8 J	7 J
Dissolved Metals (ug/l)									
Aluminum	87	750	5 ND	5 ND	5 ND	5 ND	5 ND	5 ND	5 ND
Antimony	30	180	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Arsenic	150	340	0.58	1.2	1	0.76	0.82	0.76	0.77
Barium	4	110	**7.6**	**10**	**9.2**	**9.5**	**9.3**	**11**	**11**
Beryllium	0.66	35	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Cadmium	0.14	0.87	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Calcium	116000	NA	6,500	11,000	11,000	10,000	10,000	10,000	10,000
Chromium	11	16	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Cobalt	23	1500	0.55	0.32	3.3	0.86	0.33	0.29	0.3
Copper	4.3	6	1	1.1	1.1	0.86	0.82	1.1	1.1
Iron	1000	NA	50 ND	110	97	87	89	120	120
Lead	1	25	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.23	0.2 ND
Magnesium	82000	NA	1,100	2,200	2,200	2,000	2,100	2,100	2,100
Manganese	120	2300	6.9	28	16	15	20	78	74
Total Mercury	0.77	1.4	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Molybdenum	NA	NA	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Nickel	25	227	0.51	0.98	0.94	0.84	0.71	0.76	0.76
Selenium	5	NA	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND
Silver	0.74	NA	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Thallium	12	110	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Vanadium	20	280	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Zinc	57	57	5 ND	5 ND	5 ND	5.3	5 ND	5 ND	5 ND

ND = non detected
ND values represent reporting limits

TABLE 26
Sediment Toxicity Test Results Relative to Sediment Chemistry Data - Grove Pond

H. azteca

	Laboratory Control	Flan-Sed-1 (reference)	Grove-Sed-1	Grove-Sed-2	Grove-Sed-3
%Survival	98.75	95	92.5	96.25	87.14
Growth - (mg dry biomass)	0.079	0.111	0.09	0.102	**0.07**

C. tentans

	Laboratory Control	Flan-Sed-1 (reference)	Grove-Sed-1	Grove-Sed-2	Grove-Sed-3
%Survival	85	100	92.5	98.75	96.25
Growth - (mg dry biomass)	0.93	0.95	0.928	**0.81**	0.888

Bold indicates a statistically significant result

Analytical Results

Grove Pond COPC

	Chronic (low effect) Screening Value (mg/kg)	Acute (severe effect) Screening Value (mg/kg)	Flan-Sed-1	Grove-Sed-1	Grove-Sed-2	Grove-Sed-3
Metals (mg/kg dw)						
Aluminum	25500	NA	7800	13000	3100	5800
Antimony	2	25	<28	<8.3	<7.5	<14
Arsenic	9.79	33	**110J**	**110J**	**25J**	**56J**
Barium	0.7	NA	**73J**	**89J**	**120J**	**260J**
Beryllium	NA	NA	<2.8	1.2	<0.75	<1.4
Cadmium	0.99	4.98	**11**	**8.3**	<2.2	**4.4**
Calcium	NA	NA	5700	12000	340000	150000
Chromium	43.4	111	21	**4600**	**11000**	**38000**
Cobalt	10	NA	**12**	**20**	<2.2	4.2
Copper	31.6	149	**36**	**50**	**45**	**230**
Iron	20000	40000	13000	18000	3800	13000
Lead	35.8	128	**200J**	**260J**	**340J**	**1400J**
Magnesium	NA	NA	1200	1900	1500	2300
Manganese	460	1100	460	**500**	**970**	**2200**
Mercury (total)	0.18	1.06	**0.3**	**36**	**5.3**	**5.8**
Nickel	22.7	48.6	**26J**	**34J**	6J	**25J**
Potassium	NA	NA	700	910	<380	<700
Selenium	0.29	NA	<56	<17	<15	<28
Silver	1	3.7	<8.3	<2.5	<2.2	<4.2
Sodium	NA	NA	<1400	630	880	1100
Thallium	NA	NA	<56	<50	<15	<60
Vanadium	50	NA	39	31	47	**81**
Zinc	121	459	**280**	**310**	110	**310**
Polycyclic Aromatic Hydrocarbons (mg/kg dw)						
Acenaphthylene	0.044	0.64	**0.17**	**0.22**	**0.046**	**0.079**
Anthracene	0.0572	0.845	**0.25**	**0.37**	**0.11**	**0.13**
Benzo(a)anthracene	0.108	1.05	**0.68**	**1**	**0.21**	**0.33**
Benzo(a)pyrene	0.15	1.45	**0.85**	**1.1**	**0.19**	**0.37**
Benzo(b)fluoranthene	0.24	134	**1.5**	**2.4**	**0.36**	**0.61**
Benzo(g,h,i)perylene	0.17	32	**0.93**	**1.3**	0.028	0.084
Benzo(k)fluoranthene	0.24	134	**0.5**	**0.65**	0.11	0.21
Chrysene	0.166	1.29	**1.1**	**1.7**	**0.35**	**0.43**
Dibenzo(a,h)anthracene	0.033	13	0.19	**0.3**	**0.052**	0.03
Fluoranthene	0.423	2.23	**2.2**	**3.1**	**0.78**	**0.84**
Fluorene	0.0774	0.536	**0.2**	**0.25**	**0.084**	0.069
Indeno(1,2,3-cd)pyrene	0.2	32	**0.78**	**1.1**	<0.009	0.037
Naphthalene	0.176	0.561	0.14	**2.1**	**0.28**	**2.7**
Phenanthrene	0.204	1.17	**1.1**	**1.5**	**0.6**	**0.43**
Pyrene	0.195	1.52	**1.7**	**2.3**	**0.59**	**0.73**
Total PAHs	1.61	22.8	**12.331**	**19.458**	**3.829**	**7.101**
Pesticides (mg/kg dw)						
4,4'-DDD	0.00488	0.028	**0.05**	**0.032**	<0.0021	**0.47**
4,4'-DDE	0.00316	0.0313	**0.17**	**0.076**	**0.096**	**0.31**
4,4'-DDT	0.00416	0.0629	0.0072J	<0.0049	<0.0021	<0.0033
Total Organic Carbon (mg/kg dry weight)			280000J	240000J	66000J	220000J

NA = No benchmark available
J = estimated
< = not detected at given RL.
Note: for ND, 1/2 the RL was used to calculate total PAHs and to calculate [SEM] total.

Bold indicates exceedance of low effect benchmark.
Shade indicates exceedance of high level benchmark.

TABLE 27
Sediment Toxicity Test Results Relative to Sediment Chemistry Data Plow Shop Pond

H. azteca

	Laboratory Control	Flan-Sed-1	Plow-Sed-1	Plow-Sed-2	Plow-Sed-3	Plow-Sed-4	Plow-Sed-5	Plow-Sed-6	Plow-Sed-7	Laboratory Control	Flan-Sed-1	Plow-Sed-8	Plow-Sed-9	Plow-Sed-10	Plow-Sed-11
%Survival	100	95	90	90	95	80	93.75	90	95	100	95	91.25	**48.75**	95	88.75
Growth - (mg dry biomass)	0.102	0.111	**0.08**	**0.075**	**0.075**	**0.065**	0.098	0.09	0.1	0.079	0.111	0.101	**0.033**	0.092	**0.078**

C. tentans

	Laboratory Control	Flan-Sed-1	Plow-Sed-1	Plow-Sed-2	Plow-Sed-3	Plow-Sed-4	Plow-Sed-5	Plow-Sed-6	Plow-Sed-7	Laboratory Control	Flan-Sed-1	Plow-Sed-8	Plow-Sed-9	Plow-Sed-10	Plow-Sed-11
%Survival	92.5	100	98.75	100	97.5	98.75	93.75	97.5	97.5	85	100	91.25	**45**	95	90
Growth - (mg dry biomass)	1.238	0.95	1.089	1.01	1.063	1.297	1.127	1.208	1.179	0.93	0.95	0.843	**0.082**	0.975	1.003

Bold indicates a statistically significant result

Analytical Results

Plow Shop Pond COPC

Plow Shop Pond COPC	Chronic (low effect) Screening Value (mg/kg)	Acute (severe effect) Screening Value (mg/kg)	Flan-Sed-1	Plow-Sed-1	Plow-Sed-2	Plow-Sed-3	Plow-Sed-4	Plow-Sed-5	Plow-Sed-6	Plow-Sed-7	Flan-Sed-1	Plow-Sed-8	Plow-Sed-9	Plow-Sed-10	Plow-Sed-11
Metals (mg/kg dw)															
Aluminum	25500	NA	7800	14000	5500	**27000**	1900	8600	11000	12000	7800	10000	10000	11000	2700
Antimony	2	25	28 ND	12 ND	110 ND	10 ND	96 ND	12 ND	12 ND	22 ND	28 ND	12 ND	9.3 ND	9.3 ND	100 ND
Arsenic	9.79	33	**110** J	**410** J	**2800** J	**310** J	**4300** J	**310** J	**290** J	**270** J	**110** J	**210** J	**130** J	**260** J	**1800** J
Barium	0.7	NA	**73** J	**180** J	**270** J	**97** J	**220** J	**84** J	**68** J	**90** J	**73** J	**100** J	**120** J	**110** J	**120** J
Beryllium	NA	NA	2.8 ND	1.8	11 ND	1.2	9.6 ND	1.2 ND	1.2	2.2 ND	2.8 ND	1.2 ND	2.1	1.4	10 ND
Cadmium	0.99	4.98	**11**	**16**	**36**	**3.6**	**50**	**7**	**6.5**	**13**	**11**	**9.9**	**9.2**	**15**	**23**
Calcium	NA	NA	5700	7100	15000	3600	14000	12000	8600	6800	5700	4800	5400	4500	15000
Chromium	43.4	111	21	**6200**	**2300**	**70**	**410**	**2500**	**4300**	**4600**	21	**1800**	**1700**	**4200**	**330**
Cobalt	10	NA	**12**	**27**	**22**	**15**	**20**	**16**	**19**	**22**	**12**	**19**	**16**	**22**	**28**
Copper	31.6	149	**36**	**95**	**48**	**33**	29 ND	**45**	**68**	**84**	**36**	**150**	**830**	**88**	31 ND
Iron	20000	40000	13000	**54000**	**360000**	**44000**	**370000**	**27000**	**23000**	**21000**	13000	**22000**	**27000**	**24000**	**280000**
Lead	35.8	128	**200** J	**320** J	**160** J	**50** J	96 ND	**130** J	**200** J	**270** J	**200** J	**220** J	**700** J	**240** J	**100** ND
Magnesium	NA	NA	1200	2100	1100	5000	630	1500	1800	2100	1200	2300	3700	2000	660
Manganese	460	1100	460	**3300**	**5300**	**780**	**5300**	**940**	**530**	**560**	460	**1200**	220	**790**	**14000**
Mercury (total)	0.18	1.06	**0.3**	**93**	**26**	**0.47**	**2.6**	**28**	**78**	**56**	**0.3**	**22**	**18**	**56**	**3.2**
Nickel	22.7	48.6	**26** J	**54** J	**24** J	**33** J	13 J	**26** J	**33** J	**39** J	**26** J	**48** J	**41** J	**41** J	14 J
Potassium	NA	NA	700	1100	1500	-	1600	740	830	960	700	890	700	900	1100
Selenium	0.29	NA	56 ND	24 ND	22 ND	20 ND	19 ND	24 ND	23 ND	43 ND	56 ND	24 ND	19 ND	19 ND	210 ND
Silver	1	3.7	8.3 ND	3.7 ND	33 ND	3.1 ND	29 ND	3.6 ND	3.5 ND	6.5 ND	8.3 ND	3.6 ND	2.8 ND	2.8 ND	31 ND
Sodium	NA	NA	1400 ND	940	530	-	480 ND	670	580 ND	1100 ND	1400 ND	830	470 ND	570	5200 ND
Thallium	NA	NA	56 ND	80 ND	220 ND	100 ND	400 ND	60 ND	60 ND	43 ND	56 ND	60 ND	60 ND	60 ND	210 ND
Vanadium	50	NA	39	**62**	33 ND	34	29 ND	26	36	50	39	35	**56**	40	31 ND
Zinc	121	459	**280**	**500**	**200**	71	77	**200**	**280**	**370**	**280**	**320**	**1100**	**370**	97
Polycyclic Aromatic Hydrocarbons (mg/kg dw)															
Acenaphthylene	0.044	0.64	**0.17**	**0.24**	**0.095**	0.026	0.031	**0.098**	**0.2**	**0.31**	**0.17**	**0.18**	**0.71**	**0.32**	0.036
Anthracene	0.0572	0.845	**0.25**	**0.4**	**0.14**	0.033	0.038	**0.17**	**0.39**	**0.49**	**0.25**	**0.36**	**3.4**	**0.54**	0.052
Benzo(a)anthracene	0.108	1.05	**0.68**	**1**	**0.37**	**0.13**	0.09	**0.43**	**0.98**	**1.2**	**0.68**	**0.91**	**7.1**	**1.2**	0.11
Benzo(a)pyrene	0.15	1.45	**0.85**	**1.2**	**0.42**	0.14	0.12	**0.5**	**1**	**1.3**	**0.85**	**0.97**	**6.5**	**1.3**	0.13
Benzo(b)fluoranthene	0.24	134	**1.5**	**2.3**	**0.86**	**0.25**	0.24	**0.98**	**2**	**2.9**	**1.5**	**1.8**	**11**	**2.9**	**0.29**
Benzo(g,h,i)perylene	0.17	32	**0.93**	**1.4**	**0.5**	0.12	0.12	**0.62**	**1.2**	**1.5**	**0.93**	**1**	**5.2**	**1.4**	0.14
Benzo(k)fluoranthene	0.24	134	**0.5**	**0.85**	**0.26**	0.072	0.071	**0.3**	**0.72**	**0.93**	**0.5**	**0.63**	**3.7**	**0.72**	0.085
Chrysene	0.166	1.29	**1.1**	**1.7**	**0.63**	**0.18**	**0.18**	**0.69**	**1.5**	**1.9**	**1.1**	**1.3**	**8.1**	**2**	**0.21**
Dibenzo(a,h)anthracene	0.033	13	**0.19**	**0.31**	**0.11**	0.032	0.028	**0.13**	**0.27**	**0.34**	**0.19**	**0.24**	**1.3**	**0.35**	0.033
Fluoranthene	0.423	2.23	**2.2**	**2.9**	**0.98**	0.26	0.27	**1.2**	**2.7**	**3.3**	**2.2**	**2.2**	**18**	**3.2**	0.35
Fluorene	0.0774	0.536	**0.2**	**0.28**	**0.089**	0.013	0.025	**0.16**	**0.31**	**0.35**	**0.2**	**0.23**	**1.9**	**0.31**	0.031
Indeno(1,2,3-cd)pyrene	0.2	32	**0.78**	**1.2**	**0.44**	0.11	0.11	**0.5**	**1**	**1.3**	**0.78**	**0.89**	**4.5**	**1.2**	0.12
Naphthalene	0.176	0.561	0.14	**0.34**	0.11	0.048	0.024	**0.2**	**0.41**	**0.43**	0.14	**0.38**	**2.4**	**0.57**	0.081
Phenanthrene	0.204	1.17	**1.1**	**1.2**	**0.42**	0.12	0.13	**0.6**	**1.3**	**1.5**	**1.1**	**1.2**	**10**	**1.4**	0.15
Pyrene	0.195	1.52	**1.7**	**2.3**	**0.83**	**0.24**	**0.24**	**1**	**2.1**	**2.6**	**1.7**	**1.8**	**14**	**2.5**	**0.27**
TotalPAHs	1.61	22.8	**12.29**	**17.62**	**6.254**	1.779	**1.717**	**7.578**	**16.08**	**20.35**	**12.29**	**14.09**	**97.81**	**19.91**	**2.088**
Pesticides (mg/kg dw)															
4,4'-DDD	0.00488	0.028	**0.05**	**0.071**	**0.038**	**0.056**	**0.019**	**0.055**	**0.055**	**0.087**	**0.05**	**0.43**	**0.04**	**0.039**	**0.084**
4,4'-DDE	0.00316	0.0313	**0.17**	**0.13**	**0.059**	**0.034**	**0.028**	**0.062**	**0.083**	**0.13**	**0.17**	**0.4**	**0.063**	**0.076**	**0.054**
4,4'-DDT	0.00416	0.0629	**7.2** J	0.0065 ND	0.0033 ND	**0.037**	0.0033 J	0.003 ND	0.0051 ND	**0.0065** J	**7.2** J	**0.047**	**0.0044** J	**0.0063** J	**3.6** J
Aroclors (mg/kg dw)															
Aroclor-1254	0.06	3.4	160 ND	0.13 ND	0.068 ND	**0.13**	0.058 ND	0.061 ND	0.1 ND	0.12 ND	160 ND	0.092 ND	0.053 ND	0.09 ND	68 ND
Aroclor-1260	0.005	2.4	160 ND	0.13 ND	0.068 ND	**0.05**	0.058 ND	0.061 ND	0.1 ND	0.12 ND	160 ND	0.092 ND	0.053 ND	0.09 ND	68 ND
Total Organic Carbon (mg/kg dry weight)			280000 J	270000 J	100000 J	41000 J	79000 J	340000 J	200000 J	300000 J	280000 J	280000 J	290000 J	210000 J	88000 J
		%	28	27	10	4.1	7.9	34	20	30	28	28	29	21	8.8

NA = No benchmark available
ND = not detected; J = estimated
ND values represent reporting limits
Note: for ND, 1/2 the RL was used to calculate total PAHs and to calculate [SEM] total.

Bold indicates exceedance of low effect benchmark.
Shade indicates exceedance of high level benchmark.

TABLE 28a
Grove Pond Crayfish Tissue Concentrations Compared with Critical Body Residues: Hazard Quotients

					HQs			
	Crayfish Tissue Concentrations		CBRs for Crayfish		NOAEL		LOAEL	
Chemical	**Max (mg/kg ww)**	**Average (mg/kg ww)[a]**	**Invert NOAEL (mg/kg ww)**	**Invert LOAEL (mg/kg ww)**	**Max**	**Average**	**Max**	**Average**
Aluminum	30	27	NA	NA	NA	NA	NA	NA
Arsenic	1.7	0.96	1.28	3.84	**1.3**	0.8	0.4	0.3
Barium	38	31	NA	NA	NA	NA	NA	NA
Cadmium	1.1	0.33	0.9	5.7	**1.2**	0.4	0.2	0.1
Chromium	3.5	1.2	1	3.2	**3.5**	**1.2**	**1.1**	0.4
Copper	25	19	50	150	0.5	0.4	0.2	0.1
Lead	0.89	0.48	6	18	0.1	0.1	0.0	0.0
Manganese	785	719	15.5	46.5	**50.6**	**46.4**	**16.9**	**15.5**
Methyl Mercury	0.046	0.028	0.328	3.28	0.1	0.1	0.0	0.0
Nickel	2.1	1.3	218.6	328.4	0.0	0.0	0.0	0.0
Strontium	156	140	NA	NA	NA	NA	NA	NA
Zinc	35	28	12.7	35.2	**2.7**	**2.2**	0.99	0.8

NA - indicates CBR not available and HQ could not be calculated.

TABLE 28b
Plow Shop Pond Invertebrate Tissue Concentrations Compared with Critical Body Residues: Hazard Quotients

Crayfish

					HQs			
	Crayfish Tissue		CBRs for Crayfish		NOAEL		LOAEL	
Chemical	Max (mg/kg ww)	Average (mg/kg ww)	Invert NOAEL (mg/kg ww)	Invert LOAEL (mg/kg ww)	Max	Average	Max	Average
Aluminum	2.94	2.94	NA	NA	NA	NA	NA	NA
Arsenic	1.62	1.11	1.28	3.84	**1.3**	0.9	0.4	0.3
Barium	38	38	NA	NA	NA	NA	NA	NA
Cadmium	0.62	0.18	0.9	5.7	0.7	0.2	0.1	0.0
Chromium	3.06	1.82	1	3.2	**3.1**	**1.8**	0.96	0.6
Copper	24	24	50	150	0.5	0.5	0.2	0.2
Lead	0.47	0.22	6	18	0.1	0.0	0.0	0.0
Manganese	278	278	15.5	46.5	**17.9**	**17.9**	**6.0**	**6.0**
Methyl mercury	0.04	0.03	0.328	3.28	0.1	0.1	0.0	0.0
Nickel	0.27	0.27	218.6	328.4	0.0	0.0	0.0	0.0
Strontium	157	157	NA	NA	NA	NA	NA	NA
Zinc	23	23	12.7	35.2	**1.8**	**1.8**	0.66	0.7

Mussel

					HQs			
	Mussel Tissue		CBRs for Mussels		NOAEL		LOAEL	
Chemical	Max (mg/kg ww)	Average (mg/kg ww)	Invert NOAEL (mg/kg ww)	Invert LOAEL (mg/kg ww)	Max	Average	Max	Average
Aluminum	1.12	1.12	NA	NA	NA	NA	NA	NA
Arsenic	0.93	0.72	1.28	3.84	0.7	0.6	0.2	0.2
Barium	95	67	NA	NA	NA	NA	NA	NA
Boron	0.47	0.41	NA	NA	NA	NA	NA	NA
Cadmium	0.39	0.31	8	16	0.0	0.0	0.0	0.0
Chromium	0.72	0.62	1	3.2	0.7	0.6	0.2	0.2
Copper	0.76	0.70	15	15	0.1	0.0	0.1	0.0
Lead	0.1	0.07	7	35	0.0	0.0	0.0	0.0
Manganese	1042	738	15.5	46.5	**67**	**48**	**22**	**16**
Mercury	0.0557	0.05	3.4	10.2	0.0	0.0	0.0	0.0
Nickel	0.15	0.12	218.6	328.4	NA	NA	NA	NA
Selenium	0.18	0.17	0.294	2.94	0.6	0.6	0.06	0.1
Strontium	26	19	NA	NA	NA	NA	NA	NA
Zinc	22	19	46	80	0.5	0.4	0.27	0.2

TABLE 29
AVS/SEM Results - Grove Pond

	Simultaneously-Extracted Metals (umole/g)			
Chemical	**Flan-Sed-1**	**Grove-Sed-1**	**Grove-Sed-2**	**Grove-Sed-3**
Antimony	<0.309	<0.219	<0.087	<0.205
Cadmium	0.089	0.042	<0.008	0.023
Chromium	0.224	39.7	152	547
Copper	0.628	0.392	0.1	0.771
Lead	0.882	0.96	1.48	7.07
Mercury	0.00187	<0.00133	<0.00053	<0.00125
Nickel	<0.256	0.197	<0.072	0.208
Zinc	4.26	3.7	1.22	4.46
[SEM] total	6.37	45	155	560
Acid Volatile Sulfides (umole/g)	11.3	43	46.6	105
Ratio [SEM]:[AVS]	0.56	**1.05**	**3.32**	**5.33**
Difference [SEM]-[AVS]	-4.93	**2.10**	**108**	**455**

< = not detected at given RL.

TABLE 30
AVS/SEM Results Plow Shop Pond

	Simultaneously-Extracted Metals (umole/g)											
Chemicals	**Flan-Sed-1**	**Plow-Sed-1**	**Plow-Sed-2**	**Plow-Sed-3**	**Plow-Sed-4**	**Plow-Sed-5**	**Plow-Sed-6**	**Plow-Sed-7**	**Plow-Sed-8**	**Plow-Sed-9**	**Plow-Sed-10**	**Plow-Sed-11**
Antimony	<0.309	<0.313	<0.162	-	<0.129	<0.252	<0.229	<0.262	<0.316	<0.138	<0.174	<0.163
Cadmium	0.089	0.082	0.024	-	0.017	0.028	0.026	0.115	0.049	0.048	0.088	0.023
Chromium	0.224	44.5	13.2	-	3.39	15.8	34.2	38.7	12	14.6	33.2	2.75
Copper	0.628	0.554	0.113	-	0.155	0.318	0.256	0.886	1.14	2.2	0.211	0.08
Lead	0.882	1.09	0.347	-	0.158	0.479	0.822	1.22	0.671	3.03	0.905	0.227
Mercury	0.00187	<0.00182	<0.000924	-	<0.00078	<0.00153	<0.00139	<0.00159	<0.00192	<0.00084	<0.00106	<0.00099
Nickel	<0.256	0.389	0.154	-	0.109	<0.21	<0.19	0.33	0.349	0.246	0.173	<0.135
Zinc	4.26	5.63	1.57	-	0.896	2.45	3.1	5.65	3.48	13.8	4.11	1.23
[SEM] total	6.4	52.4	15.5		4.8	19.3	38.6	47.0	17.8	34.0	38.8	4.5
Acid Volatile Sulfides (umole/g)	11.3	195	196	-	128	27.7	15	20.6	15	48.8	25.5	384
Ratio [SEM]:[AVS]	0.56	0.27	0.08		0.04	0.70	**2.57**	**2.28**	**1.19**	0.70	**1.52**	0.01
Difference [SEM]-[AVS]	-4.9	-142.6	-180.5		-123.2	-8.4	**23.6**	**26.4**	**2.8**	-14.8	**13.3**	-379.5

< = not detected at given RL.

TABLE 31
Surface Water Toxicity Test Results Relative to Surface Water Chemistry Data - Grove Pond Fish

	P. promelas							
	Laboratory Control	Flan-Sed-1 (reference)	Grove-SW-1	Grove-SW-2	Grove-SW-3	Grove-SW-4	Grove-SW-5	Grove-SW-6
%Survival	95	97.5	92.5	97.5	97.5	100	95	100
Growth								
Avg dry biomass (mg)[a]	0.5	0.57	0.51	0.55	0.56	0.5	0.51	0.53
Avg dry weight (mg)[b]	0.53	0.59	0.55	0.57	0.58	0.5	0.53	0.53

a. Average dry biomass = measured dry weight ÷ number of exposed organisms
b. Average dry weight = measured dry weight ÷ number of surviving organisms
Bold indicates a statistically significant result

Analytical Results

Grove Pond COPC	Benchmark (ug/L)									
Total Recoverable Metals (ug/l)	(chronic)	(acute)	Flan-SW-1	Grove-SW-1	Grove-SW-2	Grove-SW-2 (DUP)	Grove-SW-3	Grove-SW-4	Grove-SW-5	Grove-SW-6
Aluminum	87	750	**720** J	19 J	8 J	10 J	48 J	13 J	27 J	18 J
Antimony	30	180	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Arsenic	150	340	5	2.3	4.6	4.6	1.1	1.3	1.4	1.9
Barium	4	110	**17**	**23**	**13**	**13**	**18**	**15**	**14**	**15**
Beryllium	0.66	35	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Cadmium	0.14	0.87	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Calcium	116000	NA	7,100	27,000	21,000	21,000	17,000	12,000	11,000	12,000
Chromium	11	16	2 J	**20**	5 J	5 J	1 J	0.8 J	0.8 J	0.8 J
Cobalt	23	1500	0.72	0.2 ND	0.2 ND	0.2 ND	0.28	0.2 ND	0.3	0.43
Copper	4.3	6	3 J	3 J	2 J	**32**	3 J	1 J	3 J	2 J
Iron	1000	NA	**1800**	390	460 J	500	130	620	650	940
Lead	1	25	**3.5**	**2** J	0.5 J	**3.4**	0.4 J	0.3 J	0.6 J	0.5 J
Magnesium	82000	NA	1,300	3,100	2,500	2,500	2,300	2,200	2,300	2,300
Manganese	120	2300	**310**	**200**	**600**	**610**	57	**210**	**180**	**350**
Total Mercury	0.77	1.4	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Molybdenum	NA	NA	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Nickel	25	227	1.8	1.4	1	1.2	2.5	1.1	1.6	1.3
Selenium	5	NA	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND
Silver	0.74	NA	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Thallium	12	110	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Vanadium	20	280	1.3	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Zinc	57	57	13 J	6 J	5 J	8 J	8 J	8 J	8 J	7 J
Dissolved Metals (ug/l)										
Aluminum	87	750	5 ND	5 ND	5 ND	5 ND	15	5 ND	6.2	6.4
Antimony	30	180	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Arsenic	150	340	0.58	1.7	4	3.9	1.3	0.88	1	1.4
Barium	4	110	**7.6**	**21**	**13**	**13**	**18**	**13**	**12**	**14**
Beryllium	0.66	35	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Cadmium	0.14	0.87	0.2 ND	0.2 ND	0.2 ND	ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Calcium	116000	NA	6,500	27,000	21,000	21,000	16,000	11,000	12,000	12,000
Chromium	11	16	0.5 ND	3.9	2.1	2.1	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Cobalt	23	1500	0.55	0.2 ND	1.1	0.3	0.44	1.7	3.7	4
Copper	4.3	6	1	1.7	0.91	1.4	0.52	0.95	0.66	0.73
Iron	1000	NA	50 ND	160	240	260	58	180	240	350
Lead	1	25	0.2 ND	0.39	0.22	0.24	0.2 ND	0.24	0.2 ND	0.2 ND
Magnesium	82000	NA	1,100	3,100	2,500	2,600	2,200	2,200	2,400	2,400
Manganese	120	2300	6.9	**130**	**540**	**520**	46	50	**120**	**310**
Total Mercury	0.77	1.4	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Molybdenum	NA	NA	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Nickel	25	227	0.51	1.2	0.98	0.91	1.4	1.1	1.3	1.3
Selenium	5	NA	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND
Silver	0.74	NA	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Thallium	12	110	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Vanadium	20	280	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Zinc	57	57	5 ND	5 ND	5 ND	5 ND	5 ND	6.3	5 ND	5 ND

ND = non detected
ND values represent reporting limits

TABLE 32
Surface Water Toxicity Test Results Relative to Surface Water Chemistry Data - Plow Shop Pond Fish

			P. promelas					
	Laboratory Control	Flan-Sed-1 (reference)	Plow-SW-1	Plow-SW-2	Plow-SW-3	Plow-SW-4	Plow-SW-5	Plow-SW-6
%Survival	95	97.5	95	100	97.5	95	100	95
Growth								
Avg dry biomass (mg)[a]	0.5	0.57	0.49	0.58	0.55	0.53	0.55	0.56
Avg dry weight (mg)[b]	0.53	0.59	0.51	0.58	0.56	0.56	0.55	0.59

a. Average dry biomass = measured dry weight ÷ number of exposed organisms
b. Average dry weight = measured dry weight ÷ number of surviving organisms
Bold indicates a statistically significant result

Analytical Results

Plow Shop Pond COPC	Benchmark (ug/L)								
Total Recoverable Metals (ug/l)	(chronic)	(acute)	Flan-SW-1	Plow-SW-1	Plow-SW-2	Plow-SW-3	Plow-SW-4	Plow-SW-5	Plow-SW-6
Aluminum	87	750	**720** J	12 J	10 J	8 J	16 J	12 J	11 J
Antimony	30	180	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Arsenic	150	340	5	2	1.4	1 ND	1 ND	1 ND	1 ND
Barium	4	110	**17**	**11**	**9.2**	**9.7**	**9.4**	**11**	**11**
Beryllium	0.66	35	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Cadmium	0.14	0.87	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Calcium	116000	NA	7,100	12,000	11,000	10,000	10,000	10,000	10,000
Chromium	11	16	2 J	0.9 J	0.8 J	0.9 J	1	1 J	1 J
Cobalt	23	1500	0.72	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Copper	4.3	6	3 J	2 J	2 J	1 J	3 J	**6** J	2 J
Iron	1000	NA	**1800**	420	280	220	220	260	280
Lead	1	25	**3.5**	0.3 J	0.2 J	0.2 ND	0.4 J	0.3 J	0.4 J
Magnesium	82000	NA	1,300	2,300	2,100	2,000	1,900	2,000	2,000
Manganese	120	2300	**310**	34	16	27	29	91	87
Total Mercury	0.77	1.4	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Molybdenum	NA	NA	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Nickel	25	227	1.8	1	0.91	0.8	1.4	0.85	0.94
Selenium	5	NA	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND
Silver	0.74	NA	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Thallium	12	110	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Vanadium	20	280	1.3	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Zinc	57	57	13 J	3 J	9 J	4 J	6 J	8 J	7 J
Dissolved Metals (ug/l)									
Aluminum	87	750	5 ND	5 ND	5 ND	5 ND	5 ND	5 ND	5 ND
Antimony	30	180	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Arsenic	150	340	0.58	1.2	1	0.76	0.82	0.76	0.77
Barium	4	110	**7.6**	**10**	**9.2**	**9.5**	**9.3**	**11**	**11**
Beryllium	0.66	35	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Cadmium	0.14	0.87	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Calcium	116000	NA	6,500	11,000	11,000	10,000	10,000	10,000	10,000
Chromium	11	16	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Cobalt	23	1500	0.55	0.32	3.3	0.86	0.33	0.29	0.3
Copper	4.3	6	1	1.1	1.1	0.86	0.82	1.1	1.1
Iron	1000	NA	50 ND	110	97	87	89	120	120
Lead	1	25	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.23	0.2 ND
Magnesium	82000	NA	1,100	2,200	2,200	2,000	2,100	2,100	2,100
Manganese	120	2300	6.9	28	16	15	20	78	74
Total Mercury	0.77	1.4	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Molybdenum	NA	NA	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Nickel	25	227	0.51	0.98	0.94	0.84	0.71	0.76	0.76
Selenium	5	NA	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND
Silver	0.74	NA	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Thallium	12	110	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Vanadium	20	280	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Zinc	57	57	5 ND	5 ND	5 ND	5.3	5 ND	5 ND	5 ND

ND = non detected
ND values represent reporting limits

TABLE 33
Grove Pond Fish Tissue Concentrations Compared with Critical Body Residues:All Species

Chemical	Max Fish concentration (mg/Kg)	Fish NOAEL (mg/kg ww)	Carried Forth to Individual Fish HQ Calculation
Inorganics			
Aluminum	**21**	8.53	**Y**
Arsenic	0.13	1.8	N
Barium	3.68	NA	N
Beryllium	0.99	NA	N
Boron	1.39	NA	N
Cadmium	**1.02**	0.036	**Y**
Chromium	**1.80**	0.58	**Y**
Copper	**1.35**	0.28	**Y**
Lead	**5.02**	0.34	**Y**
Manganese	54	NA	N
Mercury	**1.14**	1.07	**Y**
Molybdenum	0.51	NA	N
Nickel	**4.85**	0.82	**Y**
Selenium	0.55	0.8	N
Strontium	48	NA	N
Vanadium	**0.92**	0.7	**Y**
Zinc	**42**	34	**Y**
Pesticides/PCBs			
4,4'-DDD	**0.13**	0.06	**Y**
4,4'-DDE	**0.27**	0.029	**Y**
Total PCBs	0.47	10.9	N

TABLE 34
Grove Pond Fish Tissue Concentrations Compared with Critical Body Residues: Hazard Quotients by Fish Species

Tissue Concentrations in Fish

Chemical	CBRs		Brown Bulhead		Bluegill		Largemouth Bass		Yellow Bullhead		Black crappie	Pickerel
	Fish NOAEL (mg/kg ww)	Fish LOAEL (mg/kg ww)	Max concentration (mg/Kg)	Average concentration (mg/Kg)	Max concentration (mg/Kg)	Average concentration (mg/Kg)	Max concentration (mg/Kg)	Average concentration (mg/Kg)	Max concentration (mg/Kg)	Average concentration (mg/Kg)	Concentration (mg/kg, n=1)	Concentration (mg/kg, n=1)
Aluminum	8.53	25.59	20.7	13.98	7.9	4.06	11.8	6.86	6.44	4.72	4.9	<1.5
Cadmium	0.036	0.35	0.21	0.09	0.234	0.11	1.023	0.15	0.19	0.07	<0.32	<0.23
Chromium	0.58	1.74	1.46	0.80	1.23	0.73	1.34	0.59	0.51	0.39	1.8	0.42
Copper	0.28	0.3	1.35	0.86	0.788	0.60	1.16	0.53	0.81	0.65	0.34	0.36
Lead	0.34	0.4	1.27	0.66	1.384	0.69	5.024	0.83	0.86	0.44	<2.2	<1.5
Mercury	1.07	10.7	0.0349	0.02	0.2351	0.16	1.144	0.36	0.13	0.08	<0.21	0.62
Nickel	0.82	2.46	0.9792	0.42	0.8011	0.27	4.847	0.64	0.55	0.20	<0.65	<0.45
Vanadium	0.7	2.7	0.2256	0.11	0.1655	0.10	0.9226	0.16	0.15	0.08	<0.32	<0.23
Zinc	34	40	13.54	12.37	26.27	21.65	18.56	14.40	23.68	17.06	21	42
4,4'-DDD	0.06	0.6	0.03	0.02	0.07	0.03	0.13	0.07	0.06	0.03	0.033	0.023
4,4'-DDE	0.029	0.29	0.04	0.03	0.13	0.06	0.27	0.14	0.11	0.06	0.12	0.17

Hazard Quotients

	Brown bullhead				Bluegill				Largemouth Bass			
	NOAEL		LOAEL		NOAEL		LOAEL		NOAEL		LOAEL	
Chemical	Max	Average	Max	Average	Max	Average	Max	Average	Max	Average	Max	Average
Aluminum	**2.4**	**1.6**	0.8	0.5	0.9	0.5	0.3	0.2	**1.4**	0.8	0.5	0.3
Cadmium	**5.8**	**2.4**	0.6	0.2	**6.5**	**3.1**	0.7	0.3	**28.4**	**4.1**	**2.9**	0.4
Chromium	**2.5**	**1.4**	0.8	0.5	**2.1**	**1.3**	0.7	0.4	**2.3**	**1.02**	0.8	0.3
Copper	**4.8**	**3.1**	**4.5**	**2.9**	**2.8**	**2.1**	**2.6**	**2.0**	**4.1**	**1.9**	**3.9**	**1.8**
Lead	**3.7**	**1.9**	**3.2**	**1.6**	**4.1**	**2.0**	**3.5**	**1.7**	**14.8**	**2.4**	**12.6**	**2.1**
Mercury	0.03	0.02	0.00	0.00	0.22	0.15	0.02	0.01	**1.1**	0.3	0.1	0.0
Nickel	**1.2**	0.5	0.4	0.2	0.98	0.3	0.3	0.1	**5.9**	0.8	**2.0**	0.3
Vanadium	0	0	0.1	0.0	0.2	0.1	0.1	0.0	**1.4**	0.2	0.3	0.1
Zinc	0	0	0.3	0.3	0.8	0.6	0.7	0.5	0.5	0.4	0.5	0.4
4,4'-DDD	0.5	0	0.1	0.0	**1.2**	0.5	0.1	0.0	**2.2**	**1.1**	0.2	0.1
4,4'-DDE	**1.4**	**1.1**	0.1	0.1	**4.5**	**2.2**	0.4	0.2	**9.3**	**5.0**	0.93	0.5

Hazard Quotients

	Yellow Bullhead				Black Crappie		Pickerel	
	NOAEL		LOAEL					
Chemical	Max	Average	Max	Average	NOAEL	LOAEL	NOAEL	LOAEL
Aluminum	0.8	0.6	0.3	0.2	0.6	0.2	NA	NA
Cadmium	**5.3**	**1.9**	0.5	0.2	NA	NA	NA	NA
Chromium	0.87	0.7	0.3	0.2	**3.1**	**1.03**	0.7	0.2
Copper	**2.9**	**2.3**	**2.7**	**2.2**	**1.2**	**1.1**	**1.3**	**1.2**
Lead	**2.5**	**1.3**	**2.1**	**1.1**	NA	NA	NA	NA
Mercury	0	0.1	0.0	0.0	NA	NA	0.6	0.1
Nickel	0.7	0.2	0.2	0.1	NA	NA	NA	NA
Vanadium	0	0.1	0.1	0.0	NA	NA	NA	NA
Zinc	0.7	0.5	0.6	0.4	0.6	0.5	**1.2**	**1.1**
4,4'-DDD	1.00	0.5	0.1	0.0	0.6	0.1	0	0.0
4,4'-DDE	**3.8**	**2.1**	0.4	0.2	**4.1**	0.4	**6**	0.6

NA - indicates that HQ could not be calculated because COPC was not detected in that species.

TABLE 35
Plow Shop Pond Fish Tissue Concentrations Compared with Critical Body Residues: All Species

Chemical	Max Fish concentration (mg/Kg)	Fish NOAEL (mg/kg ww)	Carried Forth to Individual Fish HQ Calculation
Aluminum	4.5	8.53	N
Arsenic	1.3	1.8	N
Barium	4.4	NA	N
Cadmium	**0.09**	0.036	**Y**
Chromium	**0.99**	0.58	**Y**
Cobalt	0.17	NA	N
Copper	**1.3**	0.28	**Y**
Lead	0.18	0.34	N
Manganese	94.7	NA	N
Mercury	**2.7**	1.07	**Y**
Nickel	0.8	0.82	N
Selenium	0.67	0.8	N
Vanadium	**0.8**	0.7	**Y**
Zinc	29.6	34	N
4,4'-DDD	**0.11**	0.06	**Y**
4,4'-DDE	**0.38**	0.029	**Y**
4,4'-DDT	0.014	0.42	N
Aroclor-1260	0.33	8.2	N

TABLE 36
Plow Shop Pond Fish Tissue Concentrations Compared with Critical Body Residues: Hazard Quotients by Fish Species

Chemical	CBRs Fish NOAEL (mg/kg ww)	CBRs Fish LOAEL (mg/kg ww)	Largemouth Bass Max concentration (mg/Kg)	Largemouth Bass Average concentration (mg/Kg)	Bullhead Max concentration (mg/Kg)	Bullhead Average concentration (mg/Kg)	Bluegill Max concentration (mg/Kg)	Bluegill Average concentration (mg/Kg)	Black crappie Max concentration (mg/Kg)	Black crappie Average concentration (mg/Kg)
Cadmium	0.036	0.35	0.09	0.04	ND	ND	ND	ND	ND	ND
Chromium	0.58	1.74	0.65	0.43	0.99	0.42	0.93	0.63	0.65	0.64
Copper	0.28	0.3	0.9	0.58	1.3	0.76	1.3	0.62	0.44	0.37
Mercury	1.07	10.7	2.7	1.38	0.4	0.28	0.54	0.31	0.7	0.62
Vanadium	0.7	2.7	ND	ND	ND	ND	0.8	0.38	ND	ND
4,4'-DDD	0.06	0.6	0.11	0.05	0.012	0.01	0.021	0.01	0.037	0.03
4,4'-DDE	0.029	0.29	0.38	0.17	0.033	0.01	0.16	0.05	0.18	0.17

Hazard Quotients

Chemical	Largemouth Bass NOAEL Max	Largemouth Bass NOAEL Average	Largemouth Bass LOAEL Max	Largemouth Bass LOAEL Average	Bullhead NOAEL Max	Bullhead NOAEL Average	Bullhead LOAEL Max	Bullhead LOAEL Average
Cadmium	**2.5**	**1.2**	0.3	0.1	NA	NA	NA	NA
Chromium	**1.1**	0.7	0.4	0.2	**1.7**	0.7	0.6	0.2
Copper	**3.2**	**2.1**	**3.0**	**1.9**	**4.6**	**2.7**	**4.3**	**2.5**
Mercury	**2.5**	**1.3**	0.3	0.1	0.4	0.3	0.0	0.0
Vanadium	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDD	**1.8**	0.8	0.2	0.1	0.2	0.1	0.0	0.0
4,4'-DDE	**13.1**	**5.8**	**1.3**	0.6	**1.1**	0.5	0.1	0.0

Chemical	Bluegill NOAEL Max	Bluegill NOAEL Average	Bluegill LOAEL Max	Bluegill LOAEL Average	Black Crappie NOAEL Max	Black Crappie NOAEL Average	Black Crappie LOAEL Max	Black Crappie LOAEL Average
Cadmium	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	**1.6**	**1.1**	0.5	0.4	**1.1**	0.4	**1.1**	0.4
Copper	**4.6**	**2.2**	**4.3**	**2.1**	**1.6**	**1.5**	**1.3**	**1.2**
Mercury	0.5	0.3	0.1	0.0	0.7	0.1	0.6	0.1
Vanadium	**1.2**	0.6	0.3	0.1	NA	NA	NA	NA
4,4'-DDD	0.4	0.1	0.0	0.0	0.6	0.1	0.5	0.1
4,4'-DDE	**5.5**	**1.6**	0.6	0.2	**6.2**	0.6	**5.9**	0.6

NA - indicates that HQ could not be calculated because COPC was not detected in that species.

Table 37
Maximum Uptake and Hazard Quotient Calculations - Grove Pond Raccoon

	EPCs								TRV (mg/kg-d)		HQ	
Chemical	Sediment (mg/kg)	Surface Water (mg/L)	Fish (mg/kg)	Invertebrates (mg/kg)	Frog (mg/kg)	Swallow Eggs (mg/kg)	Plants (mg/kg)	Uptake[a] (mg/kg-d)	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics												
aluminum	90000	1.76E-01	2.07E+01	3.00E+01	1.08E+02	3.00E+01	4.32E+01	2053.59	1.93	19.30	**1064**	**106**
Antimony	1.21E+01			1.09E+01	1.09E+01	1.09E+01	2.90E-01	1.93	0.13	1.25	**15**	**2**
arsenic	910	1.28E-01	1.33E-01	1.72E+00	4.78E-01	9.50E-01	3.93E+00	20.94	0.13	1.26	**166**	**17**
barium	470	2.30E-02	3.68E+00	3.75E+01	1.37E+01	3.75E+01	8.46E+00	15.56	5.10	15.30	**3.05**	**1.02**
Beryllium	14.1		9.88E-01	1.27E+01		1.27E+01	1.69E-02	1.65	0.66	1.98	**2.50**	0.83
cadmium	730		1.02E+00	1.07E+00	2.69E-01	5.30E-01	3.19E+01	17.60	1.00	3.00	**18**	**6**
chromium	52000	1.75E-01	1.80E+00	3.54E+00	1.14E+01	6.10E-01	4.68E+01	1182.51	2737.00	27370.00	0.43	0.04
Cobalt	70.0	4.00E-03		7.00E+01	7.00E+01	7.00E+01	8.40E+00	12.41	7.33	18.90	**1.69**	0.66
copper	13000	3.20E-02	1.35E+00	2.54E+01	5.92E+01	2.54E+01	6.24E+02	318.01	11.70	15.40	**27**	**21**
lead	1760	2.70E-02	5.02E+00	8.90E-01	2.69E+00	4.70E-01	9.50E+00	40.67	8.00	80.00	**5.08**	0.51
manganese	2500	1.04E+00	5.40E+01	7.85E+02	7.03E+01	7.85E+02	3.00E+02	150.62	88.00	284.00	**1.71**	0.53
Mercury (inorganic)	422	1.10E-03	5.70E-02	5.10E-02	2.39E-01		1.90E+00	9.65	13.20	39.60	0.73	0.24
Methylmercury	0.07044	2.51E-07	1.09E+00	4.60E-02	2.43E-01	1.08E+00	1.16E-03	0.13	0.03	0.16	**3.9**	0.78
nickel	86	3.20E-02	4.85E+00	2.14E+00	2.19E+01	2.14E+00	3.30E-01	3.53	40.00	80.00	0.09	0.04
selenium	41.2		5.54E-01		6.44E-01		7.91E-02	1.00	0.20	0.33	**4.99**	**3**
Silver	12.4			1.12E+01	1.12E+01	1.12E+01	1.49E+00	2.01	NA	NA	NA	NA
strontium			4.85E+01	1.56E+02	3.07E+01	1.56E+02		19.73	263.00	789.00	0.08	0.03
Thallium	2.00E-01			1.80E-01	1.80E-01	1.80E-01	9.60E-05	0.03	0.007	0.07	**4.3**	0.43
vanadium	140		9.23E-01	1.40E+02	3.08E-01	1.40E+02	1.68E+01	17.83	0.21	2.10	**84.9**	**8**
zinc	820	9.11E+00	4.20E+01	3.47E+01	7.34E+01	3.47E+01	1.18E-10	28.69	160.00	320.00	0.18	0.09
Pesticides/PCBs												
DDD	2.50E+00		1.30E-01	2.38E+00	2.38E+00	2.38E+00	2.81E-03	0.42	0.80	4.00	0.53	0.11
DDE	9.80E-01		2.70E-01	9.31E-01	9.31E-01	9.31E-01	1.10E-03	0.18	0.80	4.00	0.22	0.04
DDT	3.30E+00			3.14E+00	3.14E+00	3.14E+00	3.71E-03	0.55	0.80	4.00	0.69	0.14
Endrin	2.80E-02			2.80E-02	2.80E-02	2.80E-02	1.51E-05	0.00	0.09	0.92	0.05	0.01
Total PCB			4.70E-01					0.02	0.14	0.41	0.17	0.33
SVOC												
PAH (Total)	4.20E+01			5.21E+01	5.21E+01	5.21E+01	1.01E-01	8.84	1.00	3.00	**8.84**	**2.95**
4-Chlorophenyl phenyl ether	8.40E-01			8.40E-01	8.40E-01	8.40E-01	1.01E-01	0.15	NA	NA	NA	NA

Chemicals with blank spaces were either not detected or not analyzed in the given medium.
NA in TRV and HQ columns indicates TRV not available and HQ could not be calculated.

a. Uptake=$(FIR*(EPC_{SD}*SD+EPC_{FI}*FI+EPC_{IN}*IN+EPC_{FR}*FR+EPC_{EG}*EG+EPC_{PL}*PL)+WIR*EPC_{SW})*AUF/BW$

Exposure parameters as presented in Table 19 are the following:

Symbol	Value	Units
BW	5.67	Kg
FIR	1.43E+00	Kg/day
FI	0.2	unitless
IN	0.2	unitless
FR	0.2	unitless
EG	0.2	unitless
PL	0.11	unitless
SD	0.09	unitless
WIR	0.468	L/d
AUF	1	unitless

TABLE 38
Average Uptake and Hazard Quotient Calculations - Grove Pond Raccoon

	EPCs								TRV (mg/kg-d)		HQ	
Chemical	Sediment (mg/kg)	Surface Water (mg/L)	Fish (mg/kg)	Invertebrates (mg/kg)	Frog (mg/kg)	Swallow Eggs (mg/kg)	Plants (mg/kg)	Uptake[a] (mg/kg-d)	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics												
aluminum	1.07E+04	4.49E-02	6.05E+00	2.67E+01	2.20E+01	2.67E+01	5.12E+00	246.59	1.93	19.30	**128**	**13**
Antimony	1.10E+01			9.90E+00	9.90E+00	9.90E+00	2.64E-01	1.76	0.13	1.25	**14**	**1.4**
arsenic	7.89E+01	1.43E-02	1.98E-01	8.58E-01	1.43E-01	2.48E-01	3.41E-01	1.87	0.13	1.26	**15**	**1.5**
barium	8.28E+01	1.10E-02	1.27E+00	3.05E+01	4.78E+00	3.05E+01	1.49E+00	5.31	5.10	15.30	**1.04**	0.35
Beryllium	1.17E+00		6.79E-02	1.05E+00		1.05E+00	1.40E-03	0.14	0.66	1.98	0.21	0.07
cadmium	1.79E+01		1.15E-01	2.44E-01	7.24E-02	7.91E-02	7.82E-01	0.45	1.00	3.00	0.45	0.15
chromium	5.86E+03	1.31E-02	6.75E-01	1.25E+00	1.18E+00	2.15E-01	5.27E+00	133.31	2737.00	27370.00	0.049	0.005
Cobalt	1.41E+01	3.21E-03		1.41E+01	1.41E+01	1.41E+01	1.69E+00	2.50	7.33	18.90	0.34	0.13
copper	1.46E+02	7.76E-03	5.98E-01	1.90E+01	5.89E+00	1.90E+01	6.99E+00	5.74	11.70	15.40	0.49	0.37
lead	2.63E+02	7.18E-03	7.16E-01	3.50E-01	5.07E-01	2.16E-01	1.42E+00	6.09	8.00	80.00	0.76	0.08
manganese	5.97E+02	2.12E-01	1.75E+01	7.19E+02	2.30E+01	7.19E+02	7.16E+01	90.17	88.00	284.00	**1.02**	0.32
Mercury (inorganic)	2.19E+01	3.96E-04	1.00E-02	3.19E-02	7.20E-02		9.85E-02	0.51	13.20	39.60	0.04	0.01
Methylmercury	2.15E-02		1.96E-01	2.56E-02	8.04E-02	5.74E-01	3.53E-04	0.04	0.03	0.16	**1.40**	0.28
nickel	2.93E+01	4.56E-03	3.92E-01	1.26E+00	2.35E+00	1.26E+00	1.13E-01	0.93	40.00	80.00	0.02	0.01
selenium	7.61E+00		3.42E-01		2.49E-01		1.46E-02	0.20	0.20	0.33	**1.01**	0.61
Silver	3.20E+00			2.88E+00	2.88E+00	2.88E+00	3.84E-01	0.52	NA	NA	NA	NA
strontium			1.95E+01	1.40E+02	1.38E+01	1.40E+02		15.84	263.00	789.00	0.06	0.02
Thallium	1.60E-01			1.44E-01	1.44E-01	1.44E-01	7.68E-05	0.03	0.01	0.07	**3.4**	0.34
vanadium	3.24E+01		1.18E-01	3.24E+01	2.50E-01	3.24E+01	3.89E+00	4.13	0.21	2.10	**20**	**2.0**
zinc	2.68E+02	9.27E-01	1.84E+01	2.84E+01	2.29E+01	2.84E+01	3.85E-11	11.10	160.00	320.00	0.07	0.03
Pesticides/PCBs												
DDD	3.21E-01		3.98E-02	3.05E-01	3.05E-01	3.05E-01	3.61E-04	NA	0.80	4.00	NA	NA
DDE	1.22E-01		8.87E-02	1.16E-01	1.16E-01	1.16E-01	1.37E-04	0.02	0.80	4.00	0.03	0.01
DDT	9.20E-02			8.74E-02	8.74E-02	8.74E-02	1.03E-04	0.02	0.80	4.00	0.02	0.00
Endrin	1.14E-02			1.14E-02	1.14E-02	1.14E-02	6.15E-06	0.00	0.09	4.00	0.02	0.00
Total PCBs			1.29E-01					0.14	0.41	0.92	0.33	0.15
SVOC												
PAH (Total)	5.52E+00			6.85E+00	6.85E+00	6.85E+00	1.33E-02	1.16	1.00	3.00	**1.16**	0.39
4-Chlorophenyl phenyl ether	1.36E-01			1.36E-01	1.36E-01	1.36E-01	1.63E-02	0.02	NA	NA	NA	NA

Chemicals with blank spaces were either not detected or not analyzed in the given medium.
NA in TRV and HQ columns indicates TRV not available and HQ could not be calculated.

a. Uptake=(FIR*(EPC_{SD}*SD+EPC_{FI}*FI+EPC_{IN}*IN+EPC_{FR}*FR+EPC_{EG}*EG+EPC_{PL}*PL)+WIR*EPC_{SW})*AUF/BW

Exposure parameters as presented in Table 19 are the following:

Symbol	Value	Units
BW	5.67	Kg
FIR	1.43E+00	Kg/day
FI	0.2	unitless
IN	0.2	unitless
FR	0.2	unitless
EG	0.2	unitless
PL	0.11	unitless
SD	0.09	unitless
WIR	0.468	L/d
AUF	1	unitless

TABLE 39
Apportionment of Risk Based on Maximum Exposures

Grove Pond

Raccoon

	Risk Apportionment						
Chemical	Sediment	Surface Water	Fish	Invertebrates	Frog	Swallow Eggs	Plants
aluminum	**99**	0.00	0.05	0.07	0.27	0.07	0.06
Antimony	14	0.00	0.00	**28**	**28**	**28**	0.42
arsenic	**99**	0.05	0.03	0.41	0.12	0.23	0.52
barium	**69**	0.01	1.19	12.15	4.44	12.15	1.51
Beryllium	19	0.00	3.02	**39**	0.00	**39**	0.03
cadmium	**94**	0.00	0.29	0.31	0.08	0.15	5.03
Cobalt	13	0.00	0.00	**28**	**28**	**28**	1.88
copper	**93**	0.00	0.02	0.40	0.94	0.40	5.44
lead	**98**	0.01	0.62	0.11	0.33	0.06	0.65
manganese	**38**	0.06	1.81	**26**	2.35	**26**	5.53
Methylmercury	2.18	0.00	**75**	3.16	17	3.16	0.04
selenium	**94**	0.00	2.80	0.00	3.26	0.00	0.22
Thallium	14	0.00	0.00	**29**	**29**	**29**	0.01
vanadium	18	0.00	0.26	**40**	0.09	**40**	2.61
PAH (Total)	11	0.00	0.00	**30**	**30**	**30**	0.03

Mink

	Risk Apportionment		
Chemical	Sediment	Surface Water	Fish
aluminum	**98**	0.02	2.23
arsenic	**98**	0.10	1.42
cadmium	**88**	0.00	12
copper	**99**	0.16	1.02
Methylmercury	0	0.00	**100**
vanadium	**61**	0.00	**39**

Kingfisher

	Risk Apportionment	
Chemical	Surface Water	Fish
lead	1.20E-03	**100**
Methylmercury	5.15E-08	**100**
DDT		**100**
DDE		**100**
Total PCB		**100**

Black-Crowned Night Heron

	Risk Apportionment				
Chemical	Sediment	Surface Water	Fish	Invertebrates	Frog
aluminum	**97**	0.00	0.37	1	2
Antimony	3.26	0.00	0.00	**48**	**48**
Beryllium	5.88	0.00	6.80	**87**	0
cadmium	**95**	0.00	2.20	2	1
chromium	**99**	0.00	0.06	0	0
Cobalt	2.94	0.00	0.00	**49**	**49**
copper	**90**	0.00	0.15	3	7
lead	**93**	0.01	4.36	1	2
Mercury (inorganic)	**99**	0.00	0.22	0	1
Methylmercury	0.31	0.00	**79**	3	18
Thallium	3.26	0.00	0.00	**48**	**48**
vanadium	5.67	0.00	0.62	**94**	0
DDT	3.01	0.00	2.58	**47**	**47**
DDE	2.71	0.00	12	**42**	**42**
DDD	3.09	0.00	0.00	**48**	**48**

Tree Swallow

	Risk Apportionment
Chemical	Swallow stomach contents
Arsenic	**100**
Chromium	**100**
Lead	**100**
Methylmercury	**100**

Plow Shop Pond

Raccoon

	Risk Apportionment						
Chemical	Sediment	Surface Water	Fish	Invertebrates	Frog	Swallow Eggs	Plants
aluminum	**97**	0	0	0	3	0	0
Antimony	14	0	0	**28**	**28**	**28**	0
arsenic	**99**	0	0	0	0	0	1
barium	**43**	0	1	**25**	5	**25**	1
cadmium	**92**	0	0	2	1	0	5
Cobalt	13	0	0	**28**	**28**	**28**	2
copper	**91**	0	0	1	0	1	5
lead	**99**	0	0	0	0	0	1
manganese	**81**	0	0	3	0	3	12
Methylmercury	1	0	**65**	1	6	**27**	0
selenium	**78**	0	8	2	9	2	0
Thallium	14	0	0	**29**	**29**	**29**	0
vanadium	18	0	0	**40**	0	**40**	3
PAH (Total)	11	0	0	**30**	**30**	**30**	0

Mink

	Risk Apportionment		
Chemical	Sediment	Surface Water	Fish
aluminum	**98**	0	2
arsenic	**98**	0	2
manganese	**85**	5	15
Methylmercury	0	0	**100**
Thallium	**96**	0	0
vanadium	**68**	0	**32**

Kingfisher

	Risk Apportionment	
Chemical	Surface Water	Fish
arsenic		**94**
Methylmercury		**100**
4,4'-DDD		**100**
4,4'-DDE		**100**

Night Heron

	Risk Apportionment				
Chemical	Sediment	Surface Water	Fish	Invertebrates	Frog
aluminum	**83**	0	0	0	**17**
Antimony	3	0	0	**48**	**48**
arsenic	**99**	0	0	1	0
chromium	**99**	0	0	0	0
Cobalt	3	0	0	**48**	**48**
lead	**98**	0	0	1	1
Mercury (inorganic)	**97**	0	1	0	1
Methylmercury	0	0	**90**	2	8
Thallium	3	0	0	**48**	**48**
vanadium	6	0	0	**93**	0
4,4'-DDD	3	0	3	**47**	**47**
4,4'-DDE	3	0	13	**42**	**42**
4,4'-DDT	3	0	5	**46**	**46**

Swallow

	Risk Apportionment
Chemical	Swallow stomach contents
Cadmium	**100**
Chromium	**100**
Lead	**100**
Methylmercury	**100**

Table 40
Apportionment of Risk Based on Average Exposures

Grove Pond

Raccoon

	Risk Apportionment						
Chemical	Sediment	Surface Water	Fish	Invertebrates	Frog	Swallow Eggs	Plants
aluminum	**98**	0.00	0.12	0.55	0.45	0.55	0.06
Antimony	14	0.00	0.00	**28**	**28**	**28**	0.42
arsenic	**96**	0.06	0.53	2.31	0.39	0.67	0.50
barium	**35**	0.02	1.21	**29**	4.54	**29**	0.78
manganese	15	0.02	0.98	**40**	1.29	**40**	2.20
Methylmercury	1.09	0.00	**22**	2.89	9.07	**65**	0.02
selenium	**85**	0.00	8.51	0.00	6.18	0.00	0.20
Thallium	14	0.00	0	**29**	**29**	29	0.01
vanadium	18	0.00	0.14	**40**	0.31	40	2.61
PAH (Total)	11	0.00	0.00	**30**	**30**	**30**	0.03

Mink

	Risk Apportionment		
Chemical	Sediment	Surface Water	Fish
aluminum	**95**	0.04	5.31
arsenic	**79**	0.10	**20**

Belted Kingfisher

	Risk Apportionment
Chemical	Fish
Methylmercury	100
DDD	100
DDE	100

Black-Crowned Night Heron

	Risk Apportionment				
Chemical	Sediment	Surface Water	Fish	Invertebrates	Frog
Antimony	3	0	0	**48**	**48**
chromium	**99**	0	0	0	0
lead	**91**	0	4	2	3
Methylmercury	0	0	**65**	8	**27**
Thallium	3	0	0	**48**	**48**
DDD	3	0	6	**46**	**46**
DDE	2	0	**27**	**35**	**35**
DDT	3	0	0	**48**	**48**

Tree Swallow

	Risk Apportionment
Chemical	Swallow stomach contents
Chromium	100
Lead	100
Methylmercury	100

Plow Shop Pond

Raccoon

	Risk Apportionment						
Chemical	Sediment	Surface Water	Fish	Invertebrates	Frog	Swallow Eggs	Plants
Inorganics							
aluminum	**98**	0	0	0	2	0	0
Antimony	14	0	0	**28**	**28**	**28**	0
arsenic	**99**	0.0	0	0.4	0.1	0.0	0.5
barium	**25**	0	1	**35**	4	**35**	1
manganese	**41**	0	1	**26**	1	**26**	6
Methylmercury	2	0	**85**	4	9	0	0
selenium	**85**	0	5	2	5	2	0
Thallium	14	0	0	**29**	**29**	**29**	0
vanadium	18	0	1	**39**	0	**39**	3
PAH (Total)	11	0	0	**30**	30	**30**	0

Mink

	Risk Apportionment		
Chemical	Sediment	Surface Water	Fish
aluminum	**98**	0.02	2.42
arsenic	**95**	0.01	**5**
Methylmercury	0	0.00	**100**
Thallium	**99**	0.01	0.00

Belted Kingfisher

	Risk Apportionment
Chemical	Fish
Methylmercury	100
4,4'-DDD	100
4,4'-DDE	100
4,4'-DDT	100

Black-Crowned Night Heron

	Risk Apportionment				
Chemical	Sediment	Surface Water	Fish	Invertebrates	Frog
Antimony	3.26	0.00	0.00	**48**	**48**
chromium	**98**	0.00	0.38	0.88	1.17
Methylmercury	0.33	0.00	**87**	3.66	9.42
Thallium	3.26	0.01	0.00	**48**	**48**
4,4'-DDD	2.42	0.00	**22**	**38**	**38**
4,4'-DDE	2.14	0.00	**31**	**34**	**34**

Tree Swallow

	Risk Apportionment
Chemical	Swallow stomach contents
Chromium	100
Lead	100
Methylmercury	100

TABLE 41
Residual Risk - Maximum EPCs

Raccoon

	HQs - Max Exposure						Residual Risk[a]	
	Grove Pond		Plow Shop Pond		Background			
COPC	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	Grove Pond	Plow Shop Pond
Inorganics								
aluminum	**1064**	**106**	**327**	**33**	94	9.4	11	3.5
Antimony	**15**	**1.5**	**39**	**4**	0	0	100% [b]	100%
arsenic	**166**	**17**	**1234**	**123**	21	2.1	7.9	59
barium	**3.1**	**1.0**	**3.8**	**1.3**	1.2	0.39	2.6	3.2
Beryllium	**2.5**	0.8	NA	NA	0.19	0.06	13	NA
cadmium	**18**	**5.9**	**1.6**	0.5	0.33	0.11	53	4.9
Cobalt	**1.7**	0.7	**1.4**	0.6	0.29	0.11	5.8	4.9
copper	**27**	**21**	**7.3**	**5.6**	0.09	0.07	302	82
lead	**5.1**	0.5	**3.5**	0.3	0.58	0.06	8.8	6.0
manganese	**1.7**	0.5	**17**	**5.4**	1.2	0.37	1.4	15
Methylmercury	**2.3**	0.5	**6.2**	**1.2**	1.2	0.24	1.9	5.1
selenium	**5.0**	**3.0**	**2.1**	**1.3**	0	0	100%	100%
Thallium	**4.3**	0.4	**632**	**63**	0	0	100%	100%
vanadium	**85**	**8.5**	**101**	**10**	24	2.4	3.6	4.3
SVOC								
PAH (Total)	**8.8**	**2.9**	**20.8**	**6.9**	2.6	0.9	3.4	8.0

Mink

	HQs - Max Exposure						Residual Risk[a]	
	Grove Pond		Plow Shop Pond		Background			
COPC	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	Grove Pond	Plow Shop Pond
Inorganics								
aluminum	**67**	**6.7**	**20**	**2.0**	6.2	0.62	11	3.2
arsenic	**10**	**1.0**	**77**	**8**	1.2	0.1	8.5	63
cadmium	**1.2**	0.4	0.1	0.0	0.02	0.01	64	NA
copper	**1.6**	**1.2**	0.4	0.3	0.01	0.01	152	NA
manganese	0.1	0.04	**1.0**	0.3	0.07	0.02	NA	15
Methylmercury	**4.7**	0.9	**11**	**2.2**	1.2	0.2	3.8	9.0
Thallium	0.04	0.004	**5.8**	0.6	0	0	NA	100%
vanadium	**1.5**	0.2	**1.6**	0.2	0.26	0.03	5.9	6.3

Belted Kingfisher

	HQs - Max Exposure						Residual Risk[a]	
	Grove Pond		Plow Shop Pond		Background			
COPC	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	Grove Pond	Plow Shop Pond
Inorganics								
lead	**2.2**	0.2	0.1	0.0	0.00034	0.00003	6445	NA
Methylmercury	**84**	**8.4**	**198**	**20**	22.0	2.2	3.8	9.0
Pesticides/PCBs								
DDD	**4.6**	0.5	**3.9**	0.4	1.16	0.12	3.9	3.3
DDE	**9.5**	0.95	**13**	**1.3**	9.9	0.99	0.96	1.4
Total PCB	**1.3**	0.1	NA	NA	0	0	100%	100%

Black-Crowned Night Heron

	HQs - Max Exposure						Residual Risk[a]	
	Grove Pond		Plow Shop Pond		Background			
COPC	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	Grove Pond	Plow Shop Pond
Inorganics								
aluminum	**4.5**	**1.5**	**1.6**	0.5	0.44	0.15	10	3.6
Antimony	**16**	**1.6**	**40**	**4.0**	0	0	100%	100%
arsenic	0.98	0.4	**7.1**	**2.9**	0.14	0.06	NA	52
Beryllium	**1.9**	0.6	NA	NA	0.14	0.05	14	NA
cadmium	**2.8**	0.2	0.3	0.0	0.07	0.01	38	NA
chromium	**278**	**56**	**202**	**40**	0.19	0.04	1480	1077
Cobalt	**1.7**	0.7	**1.4**	0.6	0.29	0.12	5.8	4.9
copper	**1.6**	**1.2**	0.4	0.3	0.01	0.01	187	NA
lead	**9.0**	0.9	**5.9**	0.6	1.00	0.10	9.0	5.9
Mercury (inorganic)	**5.1**	**2.5**	**3.0**	**1.5**	0.01	0.003	749	450
Methylmercury	**19**	**1.9**	**39**	**3.9**	4.94	0.49	3.8	7.9
Thallium	**4.4**	0.4	**649**	**65**	0	0	100%	100%
vanadium	1.2	0.4	**1.4**	0.5	0.32	0.11	NA	4.3
Pesticides/PCBs								
DDD	**32**	**3.2**	**23**	**2.3**	0.82	0.08	38	28
DDE	**14**	**1.4**	**18**	**1.8**	3.84	0.38	3.6	4.8
DDT	**41**	**4.1**	**1.7**	0.2	0.09	0.01	458	19

a. The RR for NOAEL and LOAEL based HQs are identical.

b. 100% = all site risk due to site COPC as chemical was not detected in background media.

TABLE 42
Residual Risk - Average EPCs

Raccoon

COPC	HQs - Avg Exposure						Residual Risk[a]	
	Grove Pond		Plow Shop Pond		Background			
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	Grove Pond	Plow Shop Pond
Inorganics								
aluminum	**128**	**13**	**99**	**9.9**	85	8.5	1.5	1.2
Antimony	**14**	**1.40**	**19.85**	**1.98**	0	0	100%[b]	100%
arsenic	**15**	**1.49**	**100**	**10.0**	16	1.6	0.95	6.4
barium	**1.04**	0.35	**1.78**	0.59	1.0	0.35	0.99	1.7
manganese	**1.02**	0.32	**1.49**	0.46	1.0	0.31	1.04	2
Methylmercury	**1.40**	0.28	**1.09**	0.22	14.2	2.84	0.1	0.1
selenium	**1.01**	0.61	**1.92**	**1.16**	0	0	100%	100%
Thallium	**3.4**	0.3	**501**	**50**	0	0	100%	100%
vanadium	**20**	**1.97**	**16.3**	**1.63**	18	1.8	1.1	0.9
SVOC								
PAH (Total)	**1.16**	0.39	**2.12**	0.71	2.6	0.9	0.4	0.8

Mink

COPC	HQs - Avg Exposure						Residual Risk[a]	
	Grove Pond		Plow Shop Pond		Background			
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	Grove Pond	Plow Shop Pond
Inorganics								
aluminum	**8.18**	0.82	**6.12**	0.61	5.5	0.55	2	1.1
arsenic	**1.10**	0.11	**6.4**	**0.64**	0.9	0.1	1.2	7
Methylmercury	0.85	0.17	**2.54**	0.51	0.8	0.2	NA	3.3
Thallium	0.03	0.00	**4.46**	0.45	0	0	NA	100%

Belted Kingfisher

COPC	HQs - Avg Exposure						Residual Risk[a]	
	Grove Pond		Plow Shop Pond		Background			
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	Grove Pond	Plow Shop Pond
Inorganics								
Methylmercury	**15**	**1.51**	**45**	**4.52**	13.7	1.4	1.1	3.3
Pesticides/PCBs								
DDD	**1.40**	0.14	0.70	0.07	0.87	0.09	1.6	NA
DDE	**3.13**	0.31	**2.89**	0.29	5.7	0.57	0.55	0.5

Black-Crowned Night Heron

COPC	HQs - Avg Exposure						Residual Risk[a]	
	Grove Pond		Plow Shop Pond		Background			
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	Grove Pond	Plow Shop Pond
Inorganics								
Antimony	**14**	**1.44**	**20**	**2.03**	0	0	100%	100%
chromium	**31**	**6.29**	**12**	**2.48**	0.16	0.03	196	77
lead	**1.36**	0.14	0.86	0.09	0.80	0.08	1.7	NA
Methylmercury	**4.16**	0.42	**9**	**0.93**	17.55	1.75	0.2	0.5
Thallium	**4**	0.35	**515**	**51**	0	0	100%	100%
Pesticides/PCBs								
DDD	**4.20**	0.42	**1.15**	0.11	0.77	0.08	5	1.5
DDE	**2.05**	0.21	**1.26**	0.13	3.11	0.31	0.7	0.4
DDT	**1.13**	0.11	0.18	0.02	0.09	0.01	13	NA

a. The RR for NOAEL and LOAEL based HQs are identical.
b. 100% = all site risk due to site COPC as chemcial was not detected in background media.

TABLE 43
Maximum Uptake and Hazard Quotient Calculations - Plow Shop Pond Raccoon

	EPCs								TRV (mg/kg-d)		HQ	
Chemical	**Sediment (mg/kg)**	**Surface Water (mg/L)**	**Fish (mg/kg)**	**Invertebrates (mg/kg)**	**Frog (mg/kg)**	**Swallow Eggs (mg/kg)**	**Plants (mg/kg)**	**Uptake[a] (mg/kg-d)**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Inorganics												
aluminum	2.70E+04	2.25E-01	4.50E+00	2.94E+00	3.30E+02	2.94E+00	1.30E+01	630.40	1.93	19.30	**327**	**33**
Antimony	3.07E+01	5.00E-03		2.76E+01	2.76E+01	2.76E+01	7.37E-01	4.90	0.13	1.25	**39**	**4**
arsenic	6.80E+03	3.80E-01	1.30E+00	2.45E+00	7.05E-01	5.80E-01	2.94E+01	155.45	0.13	1.26	**1234**	**123**
barium	3.70E+02	4.40E-02	4.40E+00	9.51E+01	1.97E+01	9.51E+01	6.66E+00	19.40	5.10	15.30	**3.80**	**1.27**
Beryllium	2.72E+00	1.00E-03		2.45E+00		2.45E+00	3.26E-03	0.31	0.66	1.98	0.47	0.16
Boron				4.70E-01	4.70E-01	4.70E-01		0.07	28.00	93.60	0.00	0.00
cadmium	6.60E+01	1.50E-03	9.00E-02	6.20E-01	2.90E-01		2.88E+00	1.63	1.00	3.00	**1.63**	0.54
chromium	3.78E+04	3.00E-03	9.90E-01	3.19E+00	1.08E+01	4.70E-01	3.40E+01	859.72	2737.00	27370.00	0.31	0.03
Cobalt	5.90E+01	1.30E-02	1.70E-01	5.90E+01	5.90E+01	5.90E+01	7.08E+00	10.47	7.33	18.90	**1.43**	0.55
copper	3.45E+03	4.87E-02	1.30E+00	2.44E+01	5.29E+00	2.44E+01	1.66E+02	85.70	11.70	15.40	**7.32**	**6**
lead	1.21E+03	5.00E-03	1.80E-01	4.70E-01	1.09E+00	4.70E-01	6.56E+00	27.86	8.00	80.00	**3.48**	0.35
manganese	5.48E+04	5.90E-01	9.47E+01	1.04E+03	4.75E+01	1.04E+03	6.58E+03	1538.65	88.00	284.00	**17**	**5.42**
Mercury (inorganic)	2.50E+02		1.35E-01	6.90E-02	2.01E-01	#REF!	1.13E+00	#REF!	13.20	39.60	#REF!	#REF!
Methylmercury	8.19E-02		2.57E+00	5.60E-02	2.24E-01	1.06E+00	1.35E-03	0.20	0.03	0.16	**6.21**	**1.24**
nickel	8.78E+01	4.42E-02	8.00E-01	2.70E-01	5.02E+00	2.70E-01	3.37E-01	2.33	40.00	80.00	0.06	0.03
selenium	1.47E+01	2.00E-02	6.70E-01	1.80E-01	7.97E-01	1.80E-01	2.82E-02	0.43	0.20	0.33	**2.14**	**1.30**
Silver	2.00E+00	3.60E-03		1.80E+00	1.80E+00	1.80E+00	2.40E-01	0.32	NA	NA	NA	NA
strontium				1.57E+02	1.30E+01	1.57E+02		16.49	263.00	789.00	0.06	0.02
Thallium	2.94E+01	2.00E-02		2.65E+01	2.65E+01	2.65E+01	1.41E-02	4.67	0.01	0.07	**632**	**63**
vanadium	1.66E+02	1.50E-03	8.00E-01	1.66E+02	6.93E-01	1.66E+02	1.99E+01	21.14	0.21	2.10	**101**	**10**
zinc	1.10E+03	5.81E-02	2.96E+01	2.33E+01	9.72E+01	2.33E+01	1.58E-10	33.72	160.00	320.00	0.21	0.11
Pesticides												
4,4'-DDD	1.80E+00		1.10E-01	1.71E+00	1.71E+00	1.71E+00	2.02E-03	0.31	0.80	4.00	0.38	0.08
4,4'-DDE	1.30E+00		3.80E-01	1.24E+00	1.24E+00	1.24E+00	1.46E-03	0.24	0.80	4.00	0.29	0.06
4,4'-DDT	1.30E-01		1.40E-02	1.24E-01	1.24E-01	1.24E-01	1.46E-04	0.02	0.80	4.00	0.03	0.01
Aroclor 1254	1.30E-01			6.89E-02	6.89E-02	6.89E-02	1.56E-04	0.01	0.14	0.41	0.10	0.03
Aroclor 1260	5.00E-02		3.30E-01	2.65E-02	2.65E-02	2.65E-02	6.00E-05	0.02	0.14	0.41	0.16	0.05
SVOC												
PAH (Total)	9.87E+01			1.22E+02	1.22E+02	1.22E+02	2.37E-01	20.76	1.00	3.00	**21**	**6.92**
VOC												
Acetone	2.6			1.30E-01	1.30E-01	1.30E-01	1.62E+01	0.53	10.00	50.00	0.05	0.01

Chemicals with blank spaces were either not detected or not analyzed in the given medium.
NA in TRV and HQ columns indicates TRV not available and HQ could not be calculated.

a. Uptake=$(FIR*(EPC_{SD}*SD+EPC_{FI}*FI+EPC_{IN}*IN+EPC_{FR}*FR+EPC_{EG}*EG+EPC_{PL}*PL)+WIR*EPC_{SW})*AUF/BW$

Exposure parameters as presented in Table 19 are the following:

Symbol	Value	Units
BW	5.67	Kg
FIR	1.43E+00	Kg/day
FI	0.2	unitless
IN	0.2	unitless
FR	0.2	unitless
EG	0.2	unitless
PL	0.11	unitless
SD	0.09	unitless
WIR	0.468	L/d
AUF	1	unitless

TABLE 44
Average Uptake and Hazard Quotient Calculations - Plow Shop Pond Raccoon

	EPCs								TRV (mg/kg-d)		HQ	
Chemical	Sediment (mg/kg)	Surface Water (mg/L)	Fish (mg/kg)	Invertebrates (mg/kg)	Frog (mg/kg)	Swallow Eggs (mg/kg)	Plants (mg/kg)	Uptake[a] (mg/kg-d)	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics												
aluminum	8.23E+03	1.82E-02	2.06E+00	2.03E+00	7.49E+01	2.03E+00	3.95E+00	190.97	1.93	19.30	**99**	**9.9**
Antimony	1.56E+01	1.45E-03		1.40E+01	1.40E+01	1.40E+01	3.73E-01	2.48	0.13	1.25	**20**	**1.98**
arsenic	5.42E+02	1.37E-02	3.20E-01	1.03E+00	2.56E-01	0.00E+00	2.34E+00	12.45	0.13	1.26	**99**	**9.9**
barium	1.01E+02	1.13E-02	1.55E+00	6.25E+01	7.25E+00	6.25E+01	1.81E+00	9.08	5.10	15.30	**1.78**	0.594
Beryllium	1.42E+00	3.56E-04		1.27E+00		1.27E+00	1.70E-03	0.16	0.66	1.98	0.24	0.081
Boron				4.07E-01		4.07E-01		0.04	28.00	93.60	0.00	0.000
cadmium	1.02E+01	4.67E-04	5.45E-02	2.25E-01	1.18E-01	0.00E+00	4.46E-01	0.26	1.00	3.00	0.26	0.088
chromium	2.27E+03	1.52E-03	5.37E-01	1.24E+00	1.65E+00	0.00E+00	2.05E+00	51.86	2737.00	27370.00	0.019	0.002
Cobalt	1.23E+01	1.94E-03	8.68E-02	1.23E+01	1.23E+01	1.23E+01	1.48E+00	2.19	7.33	18.90	0.30	0.116
copper	1.23E+02	6.04E-03	5.81E-01	4.08E+00	2.64E+00	4.08E+00	5.88E+00	3.52	11.70	15.40	0.30	0.229
lead	1.69E+02	1.30E-03	2.28E-01	1.68E-01	4.37E-01	0.00E+00	9.11E-01	3.90	8.00	80.00	0.49	0.049
manganese	2.35E+03	1.20E-01	3.02E+01	6.72E+02	1.68E+01	6.72E+02	2.82E+02	131.30	88.00	284.00	**1.49**	0.46
Mercury (inorganic)	2.70E+01		3.10E-02	4.45E-02	6.21E-02		1.22E-01	0.62	13.20	39.60	0.05	0.016
Methylmercury	3.67E-02		5.86E-01	2.48E-02	6.37E-02	6.15E-01	6.03E-04	0.07	0.03	0.16	**2.06**	0.41
nickel	2.97E+01	6.49E-03	3.82E-01	1.50E-01	8.97E-01	1.50E-01	1.14E-01	0.76	40.00	80.00	0.02	0.009
selenium	1.43E+01	5.13E-03	3.89E-01	1.72E-01	3.90E-01	1.72E-01	2.75E-02	0.38	0.20	0.33	**1.92**	**1.16**
Silver	4.87E+00	6.88E-04		4.39E+00	4.39E+00	4.39E+00	5.85E-01	0.79	NA	NA	NA	NA
strontium				3.89E+01	9.60E+00	3.89E+01		4.40	263.00	789.00	0.02	0.006
Thallium	2.33E+01	4.78E-03		2.10E+01	2.10E+01	2.10E+01	1.12E-02	3.71	0.01	0.07	**501**	**50**
vanadium	2.66E+01	5.26E-04	3.57E-01	2.66E+01	3.34E-01	2.66E+01	3.20E+00	3.41	0.21	2.10	**16**	**1.63**
zinc	1.99E+02	1.12E-02	2.00E+01	1.93E+01	3.18E+01	1.93E+01	2.86E-11	9.07	160.00	320.00	0.06	0.03
Pesticides												
4,4'-DDD	8.32E-02		1.99E-02	7.91E-02	7.91E-02	7.91E-02	9.36E-05	0.01	0.80	4.00	0.019	0.004
4,4'-DDE	6.09E-02		8.21E-02	5.79E-02	5.79E-02	5.79E-02	6.85E-05	0.01	0.80	4.00	0.018	0.004
4,4'-DDT	1.16E-02		6.24E-03	1.10E-02	1.10E-02	1.10E-02	1.30E-05	0.00	0.80	4.00	0.003	0.001
Aroclor 1254	5.00E-02			2.65E-02	2.65E-02	2.65E-02	6.00E-05	0.01	0.14	0.41	0.038	0.013
Aroclor 1260	4.27E-02		7.20E-02	2.26E-02	2.26E-02	2.26E-02	5.13E-05	0.01	0.14	0.41	0.059	0.020
SVOC												
PAH (Total)	1.01E+01			1.25E+01	1.25E+01	1.25E+01	2.42E-02	2.12	1.00	3.00	**2.12**	0.71
VOC												
Acetone	1.05E-02			5.25E-04	5.25E-04	5.25E-04	6.55E-02	0.00	10.00	50.00	0.000	0.000

Chemicals with blank spaces were either not detected or not analyzed in the given medium.
NA in TRV and HQ columns indicates TRV not available and HQ could not be calculated.

a. Uptake=$(FIR*(EPC_{SD}*SD+EPC_{FI}*FI+EPC_{IN}*IN+EPC_{FR}*FR+EPC_{EG}*EG+EPC_{PL}*PL)+WIR*EPC_{SW})*AUF/BW$

Exposure parameters as presented in Table 19 are the following:

Symbol	Value	Units
BW	5.67	Kg
FIR	1.43E+00	Kg/day
FI	0.2	unitless
IN	0.2	unitless
FR	0.2	unitless
EG	0.2	unitless
PL	0.11	unitless
SD	0.09	unitless
WIR	0.468	L/d
AUF	1	unitless

TABLE 45
Maximum Uptake and Hazard Quotient Calculations - Grove Pond Mink

	EPCs				TRV (mg/kg-d)		HQ	
Chemical	**Sediment (mg/kg)**	**Surface Water (mg/L)**	**Fish (mg/kg)**	**Uptake[a] (mg/kg-d)**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Inorganics								
aluminum	90000	1.76E-01	2.07E+01	128.88	1.93	19.30	**67**	**6.68**
Antimony	1.21E+01			0.02	0.13	1.25	0.14	0.01
arsenic	910	1.28E-01	1.33E-01	1.30	0.13	1.26	**10**	**1.03**
barium	470	2.30E-02	3.68E+00	1.17	5.10	15.30	0.23	0.08
Beryllium	14.1		9.88E-01	0.16	0.66	1.98	0.24	0.08
cadmium	730		1.02E+00	1.16	1.00	3.00	**1.16**	0.39
chromium	52000	1.75E-01	1.80E+00	73.06	2737.00	27370.00	0.03	0.00
Cobalt	70.0	4.00E-03		0.10	7.33	18.90	0.01	0.01
copper	13000	3.20E-02	1.35E+00	18.39	11.70	15.40	**1.57**	**1.19**
lead	1760	2.70E-02	5.02E+00	3.16	8.00	80.00	0.40	0.04
manganese	2500	1.04E+00	5.40E+01	11.07	88.00	284.00	0.13	0.04
Mercury (inorganic)	422	1.10E-03	5.70E-02	0.60	13.20	39.60	0.05	0.02
Methylmercury	0.07044	2.51E-07	1.09E+00	0.15	0.03	0.16	**4.71**	0.94
nickel	86	3.20E-02	4.85E+00	0.79	40.00	80.00	0.02	0.01
selenium	41.2		5.54E-01	0.13	0.20	0.33	0.67	0.41
Silver	12.4			0.02	NA	NA	NA	NA
strontium			4.85E+01	6.72	263.00	789.00	0.03	0.01
Thallium	2.00E-01			0.0003	0.01	0.07	0.04	0.00
vanadium	140		9.23E-01	0.32	0.21	2.10	**1.54**	0.15
zinc	820	9.11E+00	4.20E+01	7.69	160.00	320.00	0.05	0.02
Pesticides/PCBs								
DDD	2.50E+00		1.30E-01	0.02	0.80	4.00	0.03	0.01
DDE	9.80E-01		2.70E-01	0.04	0.80	4.00	0.05	0.01
DDT	3.30E+00			0.00	0.80	4.00	0.01	0.00
Endrin	2.80E-02			0.00	0.09	0.92	0.00	0.00
Total PCB			4.70E-01	0.07	0.14	0.41	0.48	0.16
SVOC								
PAH (Total)	4.20E+01			0.06	1.00	3.00	0.06	0.02
4-Chlorophenyl phenyl ether	8.40E-01			0.00	NA	NA	NA	NA

Chemicals with blank spaces were either not detected or not analyzed in the given medium.
NA in TRV and HQ columns indicates TRV not available and HQ could not be calculated.

a. Uptake=$(FIR*(EPC_{SD}*SD+EPC_{FI}*FI)+WIR*EPC_{SW})$

Exposure parameters as presented in Table 19 are the following:

Symbol	Value	Units
BW	1.40	Kg
FIR	1.96E-01	Kg/day
FI	0.99	unitless
SD	0.01	unitless
WIR	0.111	L/d
HR	2.24	Km shoreline
AUF	1	unitless

TABLE 46
Average Uptake and Hazard Quotient Calculations - Grove Pond Mink

	EPCs				TRV (mg/kg-d)		HQ	
Chemical	**Sediment (mg/kg)**	**Surface Water (mg/L)**	**Fish (mg/kg)**	**Uptake[a] (mg/kg-d)**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Inorganics								
aluminum	1.07E+04	4.49E-02	6.05E+00	15.79	1.93	19.30	**8.18**	0.82
Antimony	1.10E+01			0.02	0.13	1.25	0.12	0.01
arsenic	7.89E+01	1.43E-02	1.98E-01	0.14	0.13	1.26	**1.10**	0.11
barium	8.28E+01	1.10E-02	1.27E+00	0.29	5.10	15.30	0.06	0.02
Beryllium	1.17E+00		6.79E-02	0.01	0.66	1.98	0.02	0.01
cadmium	1.79E+01		1.15E-01	0.04	1.00	3.00	0.04	0.01
chromium	5.86E+03	1.31E-02	6.75E-01	8.30	2737.00	27370.00	0.003	0.000
Cobalt	1.41E+01	3.21E-03		0.02	7.33	18.90	0.00	0.00
copper	1.46E+02	7.76E-03	5.98E-01	0.29	11.70	15.40	0.02	0.02
lead	2.63E+02	7.18E-03	7.16E-01	0.47	8.00	80.00	0.06	0.01
manganese	5.97E+02	2.12E-01	1.75E+01	3.28	88.00	284.00	0.04	0.01
Mercury (inorganic)	2.19E+01	3.96E-04	1.00E-02	0.03	13.20	39.60	0.002	0.0008
Methylmercury	2.15E-02		1.96E-01	0.03	0.03	0.16	0.85	0.17
nickel	2.93E+01	4.56E-03	3.92E-01	0.10	40.00	80.00	0.00	0.00
selenium	7.61E+00		3.42E-01	0.06	0.20	0.33	0.29	0.18
Silver	3.20E+00			0.00	NA	NA	NA	NA
strontium			1.95E+01	2.70	263.00	789.00	0.01	0.00
Thallium	1.60E-01			0.00	0.01	0.07	0.03	0.00
vanadium	3.24E+01		1.18E-01	0.06	0.21	2.10	0.29	0.03
zinc	2.68E+02	9.27E-01	1.84E+01	3.00	160.00	320.00	0.02	0.01
Pesticides/PCBs								
DDD	3.21E-01		3.98E-02	0.01	0.80	4.00	0.01	0.00
DDE	1.22E-01		8.87E-02	0.01	0.80	4.00	0.02	0.00
DDT	9.20E-02			0.00	0.80	4.00	0.00	0.00
Endrin	1.14E-02			0.00	0.09	0.92	0.00	0.00
Total PCBs			1.29E-01	0.02	0.14	0.41	0.13	0.04
SVOC								
PAH (Total)	5.52E+00			0.01	1.00	3.00	0.01	0.00
4-Chlorophenyl phenyl ether	1.36E-01			0.00	NA	NA	NA	NA

Chemicals with blank spaces were either not detected or not analyzed in the given medium.
NA in TRV and HQ columns indicates TRV not available and HQ could not be calculated.

a. Uptake=(FIR*(EPC_{SD}*SD+EPC_{FI}*FI)+WIR*EPC_{SW})

Exposure parameters as presented in Table 19 are the following:

Symbol	Value	Units
BW	1.40	Kg
FIR	1.96E-01	Kg/day
FI	0.99	unitless
SD	0.01	unitless
WIR	0.111	L/d
HR	2.24	Km shoreline
AUF	1	unitless

TABLE 47
Maximum Uptake and Hazard Quotient Calculations- Plow Shop Pond Mink

	EPCs				TRV (mg/kg-d)		HQ	
Chemical	**Sediment (mg/kg)**	**Surface Water (mg/L)**	**Fish (mg/kg)**	**Uptake[a] (mg/kg-d)**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Inorganics								
aluminum	2.70E+04	2.25E-01	4.50E+00	38	1.93	19.30	**20**	**1.99**
Antimony	3.07E+01	5.00E-03		0.04	0.13	1.25	0.35	0.03
arsenic	6.80E+03	3.80E-01	1.30E+00	10	0.13	1.26	**77**	**8**
barium	3.70E+02	4.40E-02	4.40E+00	1.13	5.10	15.30	0.22	0.07
Beryllium	2.72E+00	1.00E-03		0.004	0.66	1.98	0.01	0.002
Boron				0.000	28.00	93.60	NA	NA
cadmium	6.60E+01	1.50E-03	9.00E-02	0.10	1.00	3.00	0.10	0.03
chromium	3.78E+04	3.00E-03	9.90E-01	53	2737.00	27370.00	0.02	0.00
Cobalt	5.90E+01	1.30E-02	1.70E-01	0.11	7.33	18.90	0.01	0.006
copper	3.45E+03	4.87E-02	1.30E+00	5.01	11.70	15.40	0.43	0.33
lead	1.21E+03	5.00E-03	1.80E-01	1.73	8.00	80.00	0.22	0.02
manganese	5.48E+04	5.90E-01	9.47E+01	90	88.00	284.00	**1.02**	0.32
Mercury (inorganic)	2.50E+02		1.35E-01	0.37	13.20	39.60	0.03	0.009
Methylmercury	8.19E-02		2.57E+00	0.36	0.03	0.16	**11**	**2.22**
nickel	8.78E+01	4.42E-02	8.00E-01	0.24	40.00	80.00	0.01	0.003
selenium	1.47E+01	2.00E-02	6.70E-01	0.12	0.20	0.33	0.58	0.35
Silver	2.00E+00	3.60E-03		0.003	NA	NA	NA	NA
strontium				0.000	263.00	789.00	NA	NA
Thallium	2.94E+01	2.00E-02		0.04	0.01	0.07	**5.78**	0.58
vanadium	1.66E+02	1.50E-03	8.00E-01	0.34	0.21	2.10	**1.64**	0.16
zinc	1.10E+03	5.81E-02	2.96E+01	5.65	160.00	320.00	0.04	0.02
Pesticides								
4,4'-DDD	1.80E+00		1.10E-01	0.02	0.80	4.00	0.022	0.004
4,4'-DDE	1.30E+00		3.80E-01	0.05	0.80	4.00	0.068	0.014
4,4'-DDT	1.30E-01		1.40E-02	0.0021	0.80	4.00	0.003	0.001
Aroclor 1254	1.30E-01			0.0002	0.14	0.41	0.001	0.000
Aroclor 1260	5.00E-02		3.30E-01	0.0458	0.14	0.41	0.334	0.111
SVOC								
PAH (Total)	9.87E+01			0.14	1.00	3.00	0.14	0.05
VOC								
Acetone	2.6			0.004	10.00	50.00	0.000	0.000

Chemicals with blank spaces were either not detected or not analyzed in the given medium.
NA in TRV and HQ columns indicates TRV not available and HQ could not be calculated.

a. Uptake=(FIR*(EPC_{SD}*SD+EPC_{FI}*FI)+WIR*EPC_{SW})

Exposure parameters as presented in Table 19 are the following:

Symbol	Value	Units
BW	1.40	Kg
FIR	1.96E-01	Kg/day
FI	0.99	unitless
SD	0.01	unitless
WIR	0.111	L/d
HR	2.24	Km shoreline
AUF	1	unitless

TABLE 48
Average Uptake and Hazard Quotient Calculations - Plow Shop Pond Mink

	EPCs				TRV (mg/kg-d)		HQ	
Chemical	**Sediment (mg/kg)**	**Surface Water (mg/L)**	**Fish (mg/kg)**	**Uptake[a] (mg/kg-d)**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Inorganics								
aluminum	8.23E+03	1.82E-02	2.06E+00	11.81	1.93	19.30	**6.12**	0.61
Antimony	1.56E+01	1.45E-03		0.02	0.13	1.25	0.18	0.02
arsenic	5.42E+02	1.37E-02	3.20E-01	0.80	0.13	1.26	**6.38**	0.64
barium	1.01E+02	1.13E-02	1.55E+00	0.36	5.10	15.30	0.07	0.02
Beryllium	1.42E+00	3.56E-04		0.00	0.66	1.98	0.00	0.00
Boron				0.00	28.00	93.60	NA	NA
cadmium	1.02E+01	4.67E-04	5.45E-02	0.02	1.00	3.00	0.02	0.01
chromium	2.27E+03	1.52E-03	5.37E-01	3.26	2737.00	27370.00	0.001	0.000
Cobalt	1.23E+01	1.94E-03	8.68E-02	0.03	7.33	18.90	0.00	0.00
copper	1.23E+02	6.04E-03	5.81E-01	0.25	11.70	15.40	0.02	0.02
lead	1.69E+02	1.30E-03	2.28E-01	0.27	8.00	80.00	0.03	0.00
manganese	2.35E+03	1.20E-01	3.02E+01	7.48	88.00	284.00	0.08	0.03
Mercury (inorganic)	2.70E+01		3.10E-02	0.04	13.20	39.60	0.00	0.00
Methylmercury	3.67E-02		5.86E-01	0.08	0.03	0.16	**2.54**	0.51
nickel	2.97E+01	6.49E-03	3.82E-01	0.10	40.00	80.00	0.00	0.00
selenium	1.43E+01	5.13E-03	3.89E-01	0.07	0.20	0.33	0.37	0.23
Silver	4.87E+00	6.88E-04		0.01	NA	NA	NA	NA
strontium				0.00	263.00	789.00	NA	NA
Thallium	2.33E+01	4.78E-03		0.03	0.01	0.07	**4.46**	0.45
vanadium	2.66E+01	5.26E-04	3.57E-01	0.09	0.21	2.10	0.41	0.04
zinc	1.99E+02	1.12E-02	2.00E+01	3.05	160.00	320.00	0.02	0.01
Pesticides								
4,4'-DDD	8.32E-02		1.99E-02	0.00	0.80	4.00	0.004	0.001
4,4'-DDE	6.09E-02		8.21E-02	0.01	0.80	4.00	0.014	0.003
4,4'-DDT	1.16E-02		6.24E-03	0.00	0.80	4.00	0.0011	0.0002
Aroclor 1254	5.00E-02			0.00	0.14	0.41	0.001	0.0002
Aroclor 1260	4.27E-02		7.20E-02	0.01	0.14	0.41	0.0733	0.0244
SVOC								
PAH (Total)	1.01E+01			0.01	1.00	3.00	0.014	0.005
VOC								
Acetone	1.05E-02			0.00	10.00	50.00	0.0000	0.0000

Chemicals with blank spaces were either not detected or not analyzed in the given medium.
NA in TRV and HQ columns indicates TRV not available and HQ could not be calculated.

a. Uptake=(FIR*(EPC_{SD}*SD+EPC_{FI}*FI)+WIR*EPC_{SW})

Exposure parameters as presented in Table 19 are the following:

Symbol	Value	Units
BW	1.40	Kg
FIR	1.96E-01	Kg/day
FI	0.99	unitless
SD	0.01	unitless
WIR	0.111	L/d
HR	2.24	Km shoreline
AUF	1	unitless

TABLE 49
Maximum Uptake and Hazard Quotient Calculations - Grove Pond Black Crowned Night Heron

	EPCs						TRV (mg/kg-d)		HQ	
Chemical	**Sediment (mg/kg)**	**Surface Water (mg/L)**	**Fish (mg/kg)**	**Invertebrates (mg/kg)**	**Frog (mg/kg)**	**Uptake[a] (mg/kg-d)**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Inorganics										
aluminum	90000	1.76E-01	2.07E+01	3.00E+01	1.08E+02	492.57	109.70	329.10	**4.5**	**1.5**
Antimony	1.21E+01			1.09E+01	1.09E+01	1.98	0.13	1.25	**16**	**1.6**
arsenic	910	1.28E-01	1.33E-01	1.72E+00	4.78E-01	5.05	5.14	12.48	0.98	0.40
barium	470	2.30E-02	3.68E+00	3.75E+01	1.37E+01	7.32	20.80	41.70	0.35	0.18
Beryllium	14.1		9.88E-01	1.27E+01		1.28	0.66	1.98	**1.9**	0.64
cadmium	730		1.02E+00	1.07E+00	2.69E-01	4.09	1.45	20.00	**2.8**	0.20
chromium	52000	1.75E-01	1.80E+00	3.54E+00	1.14E+01	278.02	1.00	5.00	**278**	**56**
Cobalt	70.0	4.00E-03		7.00E+01	7.00E+01	12.66	7.61	18.34	**1.7**	0.69
copper	13000	3.20E-02	1.35E+00	2.54E+01	5.92E+01	76.68	47.00	61.70	**1.6**	**1.2**
lead	1760	2.70E-02	5.02E+00	8.90E-01	2.69E+00	10.12	1.13	11.30	**9.0**	0.90
manganese	2500	1.04E+00	5.40E+01	7.85E+02	7.03E+01	93.13	997.00	2991.00	0.09	0.03
Mercury (inorganic)	422	1.10E-03	5.70E-02	5.10E-02	2.39E-01	2.27	0.45	0.90	**5.1**	**2.5**
Methylmercury	0.07044	2.51E-07	1.09E+00	4.60E-02	2.43E-01	0.12	0.01	0.06	**19**	**1.9**
nickel	86	3.20E-02	4.85E+00	2.14E+00	2.19E+01	2.99	77.40	107.00	0.04	0.03
selenium	41.2		5.54E-01		6.44E-01	0.32	1.80	5.40	0.18	0.06
Silver	12.4			1.12E+01	1.12E+01	2.02	NA	NA	NA	NA
strontium			4.85E+01	1.56E+02	3.07E+01	20.64	263.00	789.00	0.08	0.03
Thallium	2.00E-01			1.80E-01	1.80E-01	0.03	0.01	0.07	**4.4**	0.44
vanadium	140		9.23E-01	1.40E+02	3.08E-01	13.14	11.40	34.20	**1.2**	0.38
zinc	820	9.11E+00	4.20E+01	3.47E+01	7.34E+01	17.94	29.50	131.00	0.61	0.14
Pesticides/PCBs										
DDD	2.50E+00		1.30E-01	2.38E+00	2.38E+00	0.44	0.01	0.14	**32**	**3.2**
DDE	9.80E-01		2.70E-01	9.31E-01	9.31E-01	0.19	0.01	0.14	**14**	**1.4**
DDT	3.30E+00			3.14E+00	3.14E+00	0.57	0.01	0.14	**41**	**4.1**
Endrin	2.80E-02			2.80E-02	2.80E-02	0.01	0.01	0.10	0.51	0.05
Total PCB			4.70E-01			0.04	0.18	1.80	0.23	0.02
SVOC										
PAH (Total)	4.20E+01			5.21E+01	5.21E+01	9.37	40.00	120.00	0.23	0.08
4-Chlorophenyl phenyl ether	8.40E-01			8.40E-01	8.40E-01	0.15	NA	NA	NA	NA

Chemicals with blank spaces were either not detected or not analyzed in the given medium.
NA in TRV and HQ columns indicates TRV not available and HQ could not be calculated.

a. Uptake=$(FIR*(EPC_{SD}*SD+EPC_{FI}*FI+EPC_{IN}*IN+EPC_{FR}*FR)+WIR*EPC_{SW})*AUF/BW$

Exposure parameters as presented in Table 19 are the following:

Symbol	Value	Units
BW	0.88	Kg
FIR	2.34E-01	Kg/day
FI	0.33	unitless
IN	0.33	unitless
FR	0.33	unitless
SD	0.02	unitless
WIR	0.0396	L/d
AUF	1	unitless

TABLE 50
Average Uptake and Hazard Quotient Calculations - Grove Pond Black Crowned Night Heron

	EPCs						TRV (mg/kg-d)		HQ	
Chemical	Sediment (mg/kg)	Surface Water (mg/L)	Fish (mg/kg)	Invertebrates (mg/kg)	Frog (mg/kg)	Uptake[a] (mg/kg-d)	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics										
aluminum	1.07E+04	4.49E-02	6.05E+00	2.67E+01	2.20E+01	61.59	109.70	329.10	0.56	0.19
Antimony	1.10E+01			9.90E+00	9.90E+00	1.80	0.13	1.25	**14**	**1.4**
arsenic	7.89E+01	1.43E-02	1.98E-01	8.58E-01	1.43E-01	0.53	5.14	12.48	0.10	0.042
barium	8.28E+01	1.10E-02	1.27E+00	3.05E+01	4.78E+00	3.65	20.80	41.70	0.18	0.09
Beryllium	1.17E+00		6.79E-02	1.05E+00		0.10	0.66	1.98	0.16	0.05
cadmium	1.79E+01		1.15E-01	2.44E-01	7.24E-02	0.13	1.45	20.00	0.09	0.01
chromium	5.86E+03	1.31E-02	6.75E-01	1.25E+00	1.18E+00	31.43	1.00	5.00	**31**	**6.3**
Cobalt	1.41E+01	3.21E-03		1.41E+01	1.41E+01	2.55	7.61	18.34	0.34	0.14
copper	1.46E+02	7.76E-03	5.98E-01	1.90E+01	5.89E+00	3.01	47.00	61.70	0.06	0.049
lead	2.63E+02	7.18E-03	7.16E-01	3.50E-01	5.07E-01	1.53	1.13	11.30	**1.4**	0.14
manganese	5.97E+02	2.12E-01	1.75E+01	7.19E+02	2.30E+01	69.86	997.00	9970.00	0.07	0.01
Mercury (inorganic)	2.19E+01	3.96E-04	1.00E-02	3.19E-02	7.20E-02	0.13	0.45	0.90	0.28	0.14
Methylmercury	2.15E-02		1.96E-01	2.56E-02	8.04E-02	0.03	0.01	0.06	**4.2**	0.42
nickel	2.93E+01	4.56E-03	3.92E-01	1.26E+00	2.35E+00	0.51	77.40	107.00	0.01	0.00
selenium	7.61E+00		3.42E-01		2.49E-01	0.09	1.80	5.40	0.05	0.02
Silver	3.20E+00			2.88E+00	2.88E+00	0.52	NA	NA	NA	NA
strontium			1.95E+01	1.40E+02	1.38E+01	15.24	263.00	789.00	0.06	0.02
Thallium	1.60E-01			1.44E-01	1.44E-01	0.03	0.01	0.07	**3.5**	0.35
vanadium	3.24E+01		1.18E-01	3.24E+01	2.50E-01	3.05	11.40	34.20	0.27	0.09
zinc	2.68E+02	9.27E-01	1.84E+01	2.84E+01	2.29E+01	7.58	29.50	131.00	0.26	0.06
Pesticides/PCBs										
DDD	3.21E-01		3.98E-02	3.05E-01	3.05E-01	0.06	0.01	0.14	**4.2**	0.42
DDE	1.22E-01		8.87E-02	1.16E-01	1.16E-01	0.03	0.01	0.14	**2.1**	0.21
DDT	9.20E-02			8.74E-02	8.74E-02	0.02	0.01	0.14	**1.1**	0.11
Endrin	1.14E-02			1.14E-02	1.14E-02	0.00	0.01	0.10	0.21	0.02
Total PCBs			1.29E-01			0.01	0.18	1.80	0.06	0.01
SVOC										
PAH (Total)	5.52E+00			6.85E+00	6.85E+00	1.23	40.00	120.00	0.03	0.010
4-Chlorophenyl phenyl ether	1.36E-01			1.36E-01	1.36E-01	0.02	NA	NA	NA	NA

NA in EPC columns indicates chemical not analyzed.
NA in TRV and HQ columns indicates TRV not available and HQ could not be calculated.
ND indicates the chemical was analyzed but not detected.
a. Uptake=(FIR*(EPC_{SD}*SD+EPC_{FI}*FI+EPC_{IN}*IN+EPC_{FR}*FR)+WIR*EPC_{SW})*AUF/BW

Exposure parameters as presented in Table 19 are the following:

Symbol	Value	Units
BW	0.88	Kg
FIR	2.34E-01	Kg/day
FI	0.33	unitless
IN	0.33	unitless
FR	0.33	unitless
SD	0.02	unitless
WIR	0.0396	L/d
AUF	1	unitless

TABLE 51
Maximum Uptake and Hazard Quotient Calculations - Plow Shop Pond Black Crowned Night Heron

	EPCs						TRV (mg/kg-d)		HQ	
Chemical	**Sediment (mg/kg)**	**Surface Water (mg/L)**	**Fish (mg/kg)**	**Invertebrates (mg/kg)**	**Frog (mg/kg)**	**Uptake[a] (mg/kg-d)**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Inorganics										
aluminum	2.70E+04	2.25E-01	4.50E+00	2.94E+00	3.30E+02	1.73E+02	1.10E+02	3.29E+02	**1.6**	0.53
Antimony	3.07E+01	5.00E-03		2.76E+01	2.76E+01	5.01E+00	1.25E-01	1.25E+00	**40**	**4.0**
arsenic	6.80E+03	3.80E-01	1.30E+00	2.45E+00	7.05E-01	3.66E+01	5.14E+00	1.25E+01	**7.1**	**2.9**
barium	3.70E+02	4.40E-02	4.40E+00	9.51E+01	1.97E+01	1.24E+01	2.08E+01	4.17E+01	0.60	0.30
Beryllium	2.72E+00	1.00E-03		2.45E+00		2.29E-01	6.60E-01	1.98E+00	0.35	0.12
Boron				4.70E-01	4.70E-01	8.25E-02	2.88E+01	1.00E+02	0.00	0.00
cadmium	6.60E+01	1.50E-03	9.00E-02	6.20E-01	2.90E-01	4.39E-01	1.45E+00	2.00E+01	0.30	0.02
chromium	3.78E+04	3.00E-03	9.90E-01	3.19E+00	1.08E+01	2.02E+02	1.00E+00	5.00E+00	**202**	**40**
Cobalt	5.90E+01	1.30E-02	1.70E-01	5.90E+01	5.90E+01	1.07E+01	7.61E+00	1.83E+01	**1.4**	0.58
copper	3.45E+03	4.87E-02	1.30E+00	2.44E+01	5.29E+00	2.11E+01	4.70E+01	6.17E+01	0.45	0.34
lead	1.21E+03	5.00E-03	1.80E-01	4.70E-01	1.09E+00	6.61E+00	1.13E+00	1.13E+01	**5.9**	0.59
manganese	5.48E+04	5.90E-01	9.47E+01	1.04E+03	4.75E+01	3.95E+02	9.97E+02	2.99E+03	0.40	0.13
Mercury (inorganic)	2.50E+02		1.35E-01	6.90E-02	2.01E-01	1.37E+00	4.50E-01	9.00E-01	**3.0**	**1.5**
Methylmercury	8.19E-02		2.57E+00	5.60E-02	2.24E-01	2.50E-01	6.40E-03	6.40E-02	**39**	**3.9**
nickel	8.78E+01	4.42E-02	8.00E-01	2.70E-01	5.02E+00	1.00E+00	7.74E+01	1.07E+02	0.01	0.01
selenium	1.47E+01	2.00E-02	6.70E-01	1.80E-01	7.97E-01	2.24E-01	1.80E+00	5.40E+00	0.12	0.04
Silver	2.00E+00	3.60E-03		1.80E+00	1.80E+00	3.27E-01	NA	NA	NA	NA
strontium				1.57E+02	1.30E+01	1.49E+01	2.63E+02	7.89E+02	0.1	0.02
Thallium	2.94E+01	2.00E-02		2.65E+01	2.65E+01	4.80E+00	7.40E-03	7.40E-02	**649**	**65**
vanadium	1.66E+02	1.50E-03	8.00E-01	1.66E+02	6.93E-01	1.56E+01	1.14E+01	3.42E+01	**1.4**	0.46
zinc	1.10E+03	5.81E-02	2.96E+01	2.33E+01	9.72E+01	1.90E+01	2.95E+01	1.31E+02	0.64	0.15
Pesticides										
4,4'-DDD	1.80E+00		1.10E-01	1.71E+00	1.71E+00	3.19E-01	1.40E-02	1.40E-01	**23**	**2.3**
4,4'-DDE	1.30E+00		3.80E-01	1.24E+00	1.24E+00	2.57E-01	1.40E-02	1.40E-01	**18**	**1.8**
4,4'-DDT	1.30E-01		1.40E-02	1.24E-01	1.24E-01	2.36E-02	1.40E-02	1.40E-01	**1.7**	0.17
Aroclor 1254	1.30E-01			6.89E-02	6.89E-02	1.28E-02	1.80E-01	1.80E+00	0.07	0.01
Aroclor 1260	5.00E-02		3.30E-01	2.65E-02	2.65E-02	3.39E-02	1.80E-01	1.80E+00	0.19	0.02
SVOC										
PAH (Total)	9.87E+01			1.22E+02	1.22E+02	2.20E+01	4.00E+01	1.20E+02	0.5	0.2
VOC										
Acetone	2.6			1.30E-01	1.30E-01	3.66E-02	6.22E+02	1.87E+03	5.89E-05	1.96E-05

Chemicals with blank spaces were either not detected or not analyzed in the given medium.
NA in TRV and HQ columns indicates TRV not available and HQ could not be calculated.

a. Uptake=(FIR*(EPC_{SD}*SD+EPC_{FI}*FI+EPC_{IN}*IN+EPC_{FR}*FR)+WIR*EPC_{SW})*AUF/BW

Exposure parameters as presented in Table 19 are the following:

Symbol	Value	Units
BW	0.88	Kg
FIR	2.34E-01	Kg/day
FI	0.33	unitless
IN	0.33	unitless
FR	0.33	unitless
SD	0.02	unitless
WIR	0.0396	L/d
AUF	1	unitless

TABLE 52
Average Uptake and Hazard Quotient Calculations - Plow Shop Pond Black Crowned Night Heron

	EPCs						TRV (mg/kg-d)		HQ	
Chemical	Sediment (mg/kg)	Surface Water (mg/L)	Fish (mg/kg)	Invertebrates (mg/kg)	Frog (mg/kg)	Uptake[a] (mg/kg-d)	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics										
aluminum	8.23E+03	1.82E-02	2.06E+00	2.03E+00	7.49E+01	5.07E+01	1.10E+02	3.29E+02	0.46	0.15
Antimony	1.56E+01	1.45E-03		1.40E+01	1.40E+01	2.54E+00	1.25E-01	1.25E+00	**20**	**2.0**
arsenic	5.42E+02	1.37E-02	3.20E-01	1.03E+00	2.56E-01	3.02E+00	5.14E+00	1.25E+01	0.59	0.24
barium	1.01E+02	1.13E-02	1.55E+00	6.25E+01	7.25E+00	6.79E+00	2.08E+01	4.17E+01	0.33	0.16
Beryllium	1.42E+00	3.56E-04		1.27E+00		1.19E-01	6.60E-01	1.98E+00	0.18	0.06
Boron				4.07E-01		3.57E-02	2.88E+01	1.00E+02	0.00	0.00
cadmium	1.02E+01	4.67E-04	5.45E-02	2.25E-01	1.18E-01	8.92E-02	1.45E+00	2.00E+01	0.06	0.00
chromium	2.27E+03	1.52E-03	5.37E-01	1.24E+00	1.65E+00	1.24E+01	1.00E+00	5.00E+00	**12**	**2.5**
Cobalt	1.23E+01	1.94E-03	8.68E-02	1.23E+01	1.23E+01	2.23E+00	7.61E+00	1.83E+01	0.29	0.12
copper	1.23E+02	6.04E-03	5.81E-01	4.08E+00	2.64E+00	1.29E+00	4.70E+01	6.17E+01	0.03	0.02
lead	1.69E+02	1.30E-03	2.28E-01	1.68E-01	4.37E-01	9.71E-01	1.13E+00	1.13E+01	0.86	0.09
manganese	2.35E+03	1.20E-01	3.02E+01	6.72E+02	1.68E+01	7.56E+01	9.97E+02	9.97E+03	0.08	0.01
Mercury (inorganic)	2.70E+01		3.10E-02	4.45E-02	6.21E-02	1.56E-01	4.50E-01	9.00E-01	0.35	0.17
Methylmercury	3.67E-02		5.86E-01	2.48E-02	6.37E-02	5.94E-02	6.40E-03	6.40E-02	**9.3**	0.93
nickel	2.97E+01	6.49E-03	3.82E-01	1.50E-01	8.97E-01	2.84E-01	7.74E+01	1.07E+02	0.00	0.00
selenium	1.43E+01	5.13E-03	3.89E-01	1.72E-01	3.90E-01	1.60E-01	1.80E+00	5.40E+00	0.09	0.03
Silver	4.87E+00	6.88E-04		4.39E+00	4.39E+00	7.96E-01	NA	NA	NA	NA
strontium				3.89E+01	9.60E+00	4.25E+00	2.63E+02	7.89E+02	0.02	0.01
Thallium	2.33E+01	4.78E-03		2.10E+01	2.10E+01	3.81E+00	7.40E-03	7.40E-02	**515**	**51**
vanadium	2.66E+01	5.26E-04	3.57E-01	2.66E+01	3.34E-01	2.54E+00	1.14E+01	3.42E+01	0.22	0.07
zinc	1.99E+02	1.12E-02	2.00E+01	1.93E+01	3.18E+01	7.30E+00	2.95E+01	1.31E+02	0.25	0.06
Pesticides										
4,4'-DDD	8.32E-02		1.99E-02	7.91E-02	7.91E-02	1.61E-02	1.40E-02	1.40E-01	**1.1**	0.11
4,4'-DDE	6.09E-02		8.21E-02	5.79E-02	5.79E-02	1.77E-02	1.40E-02	1.40E-01	**1.3**	0.13
4,4'-DDT	1.16E-02		6.24E-03	1.10E-02	1.10E-02	2.54E-03	1.40E-02	1.40E-01	0.18	0.02
Aroclor 1254	5.00E-02			2.65E-02	2.65E-02	4.92E-03	1.80E-01	1.80E+00	0.03	0.00
Aroclor 1260	4.27E-02		7.20E-02	2.26E-02	2.26E-02	1.05E-02	1.80E-01	1.80E+00	0.06	0.01
SVOC										
PAH (Total)	1.01E+01			1.25E+01	1.25E+01	2.24E+00	4.00E+01	1.20E+02	0.06	0.02
VOC										
Acetone	1.05E-02			5.25E-04	5.25E-04	1.48E-04	6.22E+02	1.87E+03	2.38E-07	7.93E-08

Chemicals with blank spaces were either not detected or not analyzed in the given medium.
NA in TRV and HQ columns indicates TRV not available and HQ could not be calculated.

a. Uptake=$(FIR*(EPC_{SD}*SD+EPC_{FI}*FI+EPC_{IN}*IN+EPC_{FR}*FR)+WIR*EPC_{SW})*AUF/BW$

Exposure parameters as presented in Table 19 are the following:

Symbol	Value	Units
BW	0.88	Kg
FIR	2.34E-01	Kg/day
FI	0.33	unitless
IN	0.33	unitless
FR	0.33	unitless
SD	0.02	unitless
WIR	0.0396	L/d
AUF	1	unitless

TABLE 53
Maximum Uptake and Hazard Quotient Calculations - Grove Pond Belted

	EPCs			TRV (mg/kg-d)		HQ	
Chemical	Surface Water (mg/L)	Fish (mg/kg)	Uptake[a] (mg/kg-d)	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics							
aluminum	1.76E-01	2.07E+01	10.23	109.70	329.10	0.09	0.03
Antimony			0.00	0.13	1.25	NA	NA
arsenic	1.28E-01	1.33E-01	0.08	5.14	12.48	0.02	0.01
barium	2.30E-02	3.68E+00	1.82	20.80	41.70	0.09	0.04
Beryllium		9.88E-01	0.49	0.66	1.98	0.74	0.25
cadmium		1.02E+00	0.50	1.45	20.00	0.35	0.03
chromium	1.75E-01	1.80E+00	0.91	1.00	5.00	0.91	0.18
Cobalt	4.00E-03		0.00	7.61	18.34	0.00	0.00
copper	3.20E-02	1.35E+00	0.67	47.00	61.70	0.01	0.01
lead	2.70E-02	5.02E+00	2.48	1.13	11.30	**2.2**	0.22
manganese	1.04E+00	5.40E+01	26.75	997.00	2991.00	0.03	0.01
Mercury (inorganic)	1.10E-03	5.70E-02	0.03	0.45	0.90	0.06	0.03
Methylmercury	2.51E-07	1.09E+00	0.54	0.0064	0.06	**84**	**8.4**
nickel	3.20E-02	4.85E+00	2.39	77.40	107.00	0.03	0.02
selenium		5.54E-01	0.27	1.80	5.40	0.15	0.05
Silver			0.00	NA	NA	NA	NA
strontium		4.85E+01	23.92	263.00	789.00	0.09	0.03
Thallium			0.00	0.01	0.07	NA	NA
vanadium		9.23E-01	0.46	11.40	34.20	0.04	0.01
zinc	9.11E+00	4.20E+01	21.72	29.50	131.00	0.74	0.17
Pesticides/PCBs							
DDD		1.30E-01	0.06	0.01	0.14	**4.6**	0.46
DDE		2.70E-01	0.13	0.01	0.14	**9.5**	0.95
DDT			0.00	0.01	0.14	NA	NA
Endrin			0.00	0.01	0.10	NA	NA
Total PCB		4.70E-01	0.23	0.18	1.80	**1.3**	0.13
SVOC							
PAH (Total)			0.00	40.00	120.00	NA	NA
4-Chlorophenyl phenyl ether			0.00	NA	NA	NA	NA

Chemicals with blank spaces were either not detected or not analyzed in the given medium.
NA in TRV and HQ columns indicates TRV not available and HQ could not be calculated.

a. Uptake=(FIR*(EPC_{FI}*FI)+WIR*EPC_{SW})*AUF/BW

Exposure parameters as presented in Table 19 are the following:

Symbol	Value	Units
BW	0.15	Kg
FIR	7.40E-02	Kg/day
FI	1	unitless
WIR	0.0165	L/d
AUF	1	unitless

TABLE 54
Average Uptake and Hazard Quotient Calculations - Grove Pond Belted Kingfisher

	EPCs			TRV (mg/kg-d)		HQ	
Chemical	**Surface Water (mg/L)**	**Fish (mg/kg)**	**Uptake[a] (mg/kg-d)**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Inorganics							
aluminum	4.49E-02	6.05E+00	2.99	109.70	329.10	0.03	0.01
Antimony			0.00	0.13	1.25	NA	NA
arsenic	1.43E-02	1.98E-01	0.10	5.14	12.48	0.02	0.01
barium	1.10E-02	1.27E+00	0.63	20.80	41.70	0.03	0.02
Beryllium		6.79E-02	0.03	0.66	1.98	0.05	0.02
cadmium		1.15E-01	0.06	1.45	20.00	0.04	0.00
chromium	1.31E-02	6.75E-01	0.33	1.00	5.00	0.33	0.07
Cobalt	3.21E-03		0.00	7.61	18.34	0.00	0.00
copper	7.76E-03	5.98E-01	0.30	47.00	61.70	0.01	0.00
lead	7.18E-03	7.16E-01	0.35	1.13	11.30	0.31	0.03
manganese	2.12E-01	1.75E+01	8.66	997.00	9970.00	0.01	0.00
Mercury (inorganic)	3.96E-04	1.00E-02	0.00	0.45	0.90	0.01	0.01
Methylmercury		1.96E-01	0.10	0.01	0.06	**15**	**1.5**
nickel	4.56E-03	3.92E-01	0.19	77.40	107.00	0.00	0.00
selenium		3.42E-01	0.17	1.80	5.40	0.09	0.03
Silver			0.00	NA	NA	NA	NA
strontium		1.95E+01	9.60	263.00	789.00	0.04	0.01
Thallium			0.00	0.01	0.07	NA	NA
vanadium		1.18E-01	0.06	11.40	34.20	0.01	0.00
zinc	9.27E-01	1.84E+01	9.18	29.50	131.00	0.31	0.07
Pesticides/PCBs							
DDD		3.98E-02	0.02	0.01	0.14	**1.4**	0.14
DDE		8.87E-02	0.04	0.01	0.14	**3.1**	0.31
DDT			0.00	0.01	0.14	NA	NA
Endrin			0.00	0.01	0.10	NA	NA
Total PCBs		1.29E-01	0.06	0.18	1.80	0.35	0.04
SVOC							
PAH (Total)			0.00	40.00	120.00	NA	NA
4-Chlorophenyl phenyl ether			0.00	NA	NA	NA	NA

Chemicals with blank spaces were either not detected or not analyzed in the given medium.
NA in TRV and HQ columns indicates TRV not available and HQ could not be calculated.

a. Uptake=(FIR*(EPC_{FI}*FI)+WIR*EPC_{SW})*AUF/BW

Exposure parameters as presented in Table 19 are the following:

Symbol	**Value**	**Units**
BW	0.15	Kg
FIR	7.40E-02	Kg/day
FI	1	unitless
WIR	0.0165	L/d
AUF	1	unitless

TABLE 55
Maximum Uptake and Hazard Quotient Calculations - Plow Shop Pond Belted Kingfisher

	EPCs			TRV (mg/kg-d)		HQ	
Chemical	Surface Water (mg/L)	Fish (mg/kg)	Uptake[a] (mg/kg-d)	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics							
aluminum	2.25E-01	4.50E+00	2.24E+00	1.10E+02	3.29E+02	0.02	0.01
Antimony	5.00E-03		5.50E-04	1.25E-01	1.25E+00	0.00	0.00
arsenic	3.80E-01	1.30E+00	6.83E-01	5.14E+00	1.25E+01	0.13	0.05
barium	4.40E-02	4.40E+00	2.18E+00	2.08E+01	4.17E+01	0.10	0.05
Beryllium	1.00E-03		1.10E-04	6.60E-01	1.98E+00	0.00	0.00
Boron			0.00E+00	2.88E+01	1.00E+02	NA	NA
cadmium	1.50E-03	9.00E-02	4.46E-02	1.45E+00	2.00E+01	0.03	0.00
chromium	3.00E-03	9.90E-01	4.89E-01	1.00E+00	5.00E+00	0.49	0.10
Cobalt	1.30E-02	1.70E-01	8.53E-02	7.61E+00	1.83E+01	0.01	0.00
copper	4.87E-02	1.30E+00	6.47E-01	4.70E+01	6.17E+01	0.01	0.01
lead	5.00E-03	1.80E-01	8.94E-02	1.13E+00	1.13E+01	0.08	0.01
manganese	5.90E-01	9.47E+01	4.68E+01	9.97E+02	2.99E+03	0.05	0.02
Mercury (inorganic)		1.35E-01	6.66E-02	4.50E-01	9.00E-01	0.15	0.07
Methylmercury		2.57E+00	1.27E+00	6.40E-03	6.40E-02	**198**	**20**
nickel	4.42E-02	8.00E-01	4.00E-01	7.74E+01	1.07E+02	0.01	0.00
selenium	2.00E-02	6.70E-01	3.33E-01	1.80E+00	5.40E+00	0.18	0.06
Silver	3.60E-03		3.96E-04	NA	NA	NA	NA
strontium			0.00E+00	2.63E+02	7.89E+02	NA	NA
Thallium	2.00E-02		2.20E-03	7.40E-03	7.40E-02	0.30	0.03
vanadium	1.50E-03	8.00E-01	3.95E-01	1.14E+01	3.42E+01	0.03	0.01
zinc	5.81E-02	2.96E+01	1.46E+01	2.95E+01	1.31E+02	0.50	0.11
Pesticides							
4,4'-DDD		1.10E-01	5.43E-02	1.40E-02	1.40E-01	**3.9**	0.4
4,4'-DDE		3.80E-01	1.87E-01	1.40E-02	1.40E-01	**13**	**1.3**
4,4'-DDT		1.40E-02	6.91E-03	1.40E-02	1.40E-01	0.49	0.05
Aroclor 1254			0.00E+00	1.80E-01	1.80E+00	NA	NA
Aroclor 1260		3.30E-01	1.63E-01	1.80E-01	1.80E+00	0.90	0.09
SVOC							
PAH (Total)			0.00E+00	4.00E+01	1.20E+02	NA	NA
VOC							
Acetone			0.00E+00	6.22E+02	1.87E+03	NA	NA

Chemicals with blank spaces were either not detected or not analyzed in the given medium.
NA in TRV and HQ columns indicates TRV not available and HQ could not be calculated.

a. Uptake=(FIR*(EPC_{FI}*FI)+WIR*EPC_{SW})*AUF/BW

Exposure parameters as presented in Table 19 are the following:

Symbol	Value	Units
BW	0.15	Kg
FIR	7.40E-02	Kg/day
FI	1	unitless
WIR	0.0165	L/d
AUF	1	unitless

TABLE 56
Average Uptake and Hazard Quotient Calculations - Plow Shop Pond Belted Kingfisher

	EPCs			TRV (mg/kg-d)		HQ	
Chemical	**Surface Water (mg/L)**	**Fish (mg/kg)**	**Uptake[a] (mg/kg-d)**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Inorganics							
aluminum	1.82E-02	2.06E+00	1.02E+00	1.10E+02	3.29E+02	0.01	0.00
Antimony	1.45E-03		1.60E-04	1.25E-01	1.25E+00	0.00	0.00
arsenic	1.37E-02	3.20E-01	1.59E-01	5.14E+00	1.25E+01	0.03	0.01
barium	1.13E-02	1.55E+00	7.64E-01	2.08E+01	4.17E+01	0.04	0.02
Beryllium	3.56E-04		3.91E-05	6.60E-01	1.98E+00	0.00	0.00
Boron			0.00E+00	2.88E+01	1.00E+02	NA	NA
cadmium	4.67E-04	5.45E-02	2.69E-02	1.45E+00	2.00E+01	0.02	0.00
chromium	1.52E-03	5.37E-01	2.65E-01	1.00E+00	5.00E+00	0.27	0.05
Cobalt	1.94E-03	8.68E-02	4.31E-02	7.61E+00	1.83E+01	0.01	0.00
copper	6.04E-03	5.81E-01	2.87E-01	4.70E+01	6.17E+01	0.01	0.00
lead	1.30E-03	2.28E-01	1.13E-01	1.13E+00	1.13E+01	0.10	0.01
manganese	1.20E-01	3.02E+01	1.49E+01	9.97E+02	9.97E+03	0.01	0.00
Mercury (inorganic)		3.10E-02	1.53E-02	4.50E-01	9.00E-01	0.03	0.02
Methylmercury		5.86E-01	2.89E-01	6.40E-03	6.40E-02	**45**	**4.5**
nickel	6.49E-03	3.82E-01	1.89E-01	7.74E+01	1.07E+02	0.00	0.00
selenium	5.13E-03	3.89E-01	1.92E-01	1.80E+00	5.40E+00	0.11	0.04
Silver	6.88E-04		7.56E-05	NA	NA	NA	NA
strontium			0.00E+00	2.63E+02	7.89E+02	NA	NA
Thallium	4.78E-03		5.26E-04	7.40E-03	7.40E-02	0.07	0.01
vanadium	5.26E-04	3.57E-01	1.76E-01	1.14E+01	3.42E+01	0.02	0.01
zinc	1.12E-02	2.00E+01	9.88E+00	2.95E+01	1.31E+02	0.33	0.08
Pesticides							
4,4'-DDD		1.99E-02	9.84E-03	1.40E-02	1.40E-01	0.70	0.07
4,4'-DDE		8.21E-02	4.05E-02	1.40E-02	1.40E-01	**2.9**	0.29
4,4'-DDT		6.24E-03	3.08E-03	1.40E-02	1.40E-01	0.22	0.02
Aroclor 1254			0.00E+00	1.80E-01	1.80E+00	NA	NA
Aroclor 1260		7.20E-02	3.55E-02	1.80E-01	1.80E+00	0.20	0.02
SVOC							
PAH (Total)			0.00E+00	4.00E+01	1.20E+02	NA	NA
VOC							
Acetone			0.00E+00	6.22E+02	1.87E+03	NA	NA

Chemicals with blank spaces were either not detected or not analyzed in the given medium.
NA in TRV and HQ columns indicates TRV not available and HQ could not be calculated.

a. Uptake=(FIR*(EPC_{FI}*FI)+WIR*EPC_{SW})*AUF/BW

Exposure parameters as presented in Table 19 are the following:

Symbol	Value	Units
BW	0.15	Kg
FIR	7.40E-02	Kg/day
FI	1	unitless
WIR	0.0165	L/d
AUF	1	unitless

TABLE 57
Maximum Uptake and Hazard Quotient Calculations - Grove Pond Tree Swallow

	Max EPCs		TRV (mg/kg-d)		HQ	
Chemical	**Swallow stomach contents (mg/kg ww)**	**Uptake[a] (mg/kg-d)**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Inorganics						
Arsenic	6.81	6.87E+00	5.14	12.48	**1.3**	0.55
Cadmium	1.39	1.40E+00	1.45	20.00	0.97	0.07
Chromium	1113	1.12E+03	1.00	5.00	**1124**	**225**
Lead	5.38	5.43E+00	1.13	11.30	**4.8**	0.48
Mercury (inorganic)	0.095	9.59E-02	0.45	0.90	0.21	0.11
Methylmercury	0.177	1.79E-01	0.01	0.06	**28**	**2.8**

a. Uptake=FIR*(EPC_{ST}*ST)*AUF/BW

Exposure parameters as presented in Table 19 are the following:

Symbol	Value	Units
BW	0.02	Kg
FIR	0.0212	kg/d
ST	1.0	Unitless
AUF	1.0	Unitless

TABLE 58
Average Uptake and Hazard Quotient Calculations - Grove Pond Tree Swallow

	Max EPCs		TRV (mg/kg-d)		HQ	
Chemical	Swallow stomach contents (mg/kg ww)	Uptake[a] (mg/kg-d)	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics						
Arsenic	1.192	1.20E+00	5.14	12.48	0.2	0.1
Cadmium	0.78	7.87E-01	1.45	20.00	0.5	0.0
Chromium	197	1.99E+02	1.00	5.00	**199**	**40**
Lead	2.46	2.48E+00	1.13	11.30	**2.2**	0.2
Mercury (inorganic)	0.06937	7.00E-02	0.45	0.90	0.2	0.1
Methylmercury	0.12883	1.30E-01	0.01	0.06	**20**	**2.0**

a. Uptake=FIR*(EPC_{ST}*ST)*AUF/BW

Exposure parameters as presented in Table 19 are the following:

Symbol	Value	Units
BW	0.02	Kg
FIR	0.0212	kg/d
ST	1.0	Unitless
AUF	1.0	Unitless

TABLE 59
Maximum Uptake and Hazard Quotient Calculations - Plow Shop Pond Tree Swallow

	Max EPCs		TRV (mg/kg-d)		HQ	
Chemical	**Swallow stomach contents (mg/kg ww)**	**Uptake[a] (mg/kg-d)**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Inorganics						
Arsenic	ND	0.00E+00	5.14	12.48	NA	NA
Cadmium	2.99	3.02E+00	1.45	20.00	**2.1**	0.2
Chromium	189	1.91E+02	1.00	5.00	**191**	**38**
Lead	1.57	1.58E+00	1.13	11.30	**1.4**	0.1
Mercury (inorganic)	0.07385	7.46E-02	0.45	0.90	0.2	0.1
Methylmercury	0.13715	1.38E-01	0.01	0.06	**22**	**2.2**

ND indicates that arsenic was not detected.

a. Uptake=FIR*(EPC_{ST})*AUF/BW

Exposure parameters as presented in Table 19 are the following:

Symbol	Value	Units
BW	0.02	Kg
FIR	0.0212	kg/d
AUF	1	unitless

TABLE 60
Average Uptake and Hazard Quotient Calculations - Plow Shop Pond Tree Swallow

	Max EPCs		TRV (mg/kg-d)		HQ	
Chemical	**Swallow stomach contents (mg/kg ww)**	**Uptake[a] (mg/kg-d)**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Inorganics						
Arsenic	ND	NA	5.14	12.48	NA	NA
Cadmium	1.43	1.44E+00	1.45	20.00	0.996	0.07
Chromium	117	1.18E+02	1.00	5.00	**118**	**24**
Lead	1.25	1.26E+00	1.13	11.30	**1.1**	0.11
Mercury (inorganic)	0.06825	6.89E-02	0.45	0.90	0.15	0.08
Methylmercury	0.127	1.28E-01	0.01	0.06	**20**	**2.0**

ND indicates that arsenic was not detected.
a. Uptake=FIR*(EPC_{ST}*ST)*AUF/BW

Exposure parameters as presented in Table 19 are the following:

Symbol	Value	Units
BW	0.02	Kg
FIR	0.0212	kg/d
ST	1.0	Unitless
AUF	1	unitless

TABLE 61
Intergrated Risk Evaluation - Grove Pond

Target Receptor Group	Measurement Endpoints (Lines of Evidence)								Integrated Risk Interpretation	COC Driving Risk
	Published Benchmarks		Laboratory Toxicity Testing		Tissue Residue Analyses		Food Chain Modeling			
	WOE	RIsk	WOE	Risk	WOE	Risk	WOE	Risk		
water column invertebrates	L-M	L	M	N		ND		ND	Low risk; no unacceptable risk.	NA
Fish	L_M	L	M	N	M-H	L		ND	Low risk; no unacceptable risk.	NA
Benthic Invertebrates	L-M	H	M-H	M	M-H	L		ND	Medium risk; unacceptable risk.	No COPC identified as cause of toxicity.
omnivorous mammals		ND		ND		ND	M-H	N	No unacceptable risk.	NA
piscivorous mammals		ND		ND		ND	M-H	N	No unacceptable risk.	NA
carnivorous birds		ND		ND		ND	M-H	M	Medium risk	chromium in sediment
piscivorous birds		ND		ND		ND	M-H	N	No unacceptable risk.	NA
insectivorous birds		ND		ND		ND	M-H	M	Medium risk; unacceptable risk unlikely.	NA

Shaded cells indicate that the measurement endpoint was not applicable to the assessment endpoint

WOE = weight of evidence
N=No significant risk identified; L-M = low-medium; M-H = medium-high; H = high
ND = not determined

TABLE 62
Integrated Risk Evaluation - Plow Shop Pond

Target Receptor Group	Measurement Endpoints (Lines of Evidence)								Integrated Risk Interpretation	COC Driving Risk
	Published Benchmarks		Laboratory Toxicity Testing		Tissue Residue Analyses		Food Chain Modeling			
	WOE	RIsk	WOE	Risk	WOE	Risk	WOE	Risk		
water column invertebrates	L-M	L	M	N		ND		ND	Low risk; no unacceptable risk.	NA
fish	L-M	L	M	N	M-H	L		ND	Low risk; no unacceptable risk.	NA
benthic invertebrates	L-M	H	M-H	M	M-H	L		ND	Medium risk; unacceptable risk.	PAH; maybe some metals
omnivorous mammals		ND		ND		ND	M-H	H	High risk; unacceptable risk	arsenic in sediment
piscivorous mammals		ND		ND		ND	M-H	N	No unacceptable risk.	NA
carnivorous birds		ND		ND		ND	M-H	L	Low risk	chromium in sediment
piscivorous birds		ND		ND		ND	M-H	M	Medium risk; unacceptable risk unlikely.	MeHg in fish
insectivorous birds		ND		ND		ND	M-H	M	Medium risk; unacceptable risk unlikely.	NA

Shaded cells indicate that the measurement endpoint was not applicable to the assessment endpoint

WOE = weight of evidence
N=No significant risk identified; L-M = low-medium; M-H = medium-high; H = high (see Attachment 4.4 for additional details)
ND = not determined

Table 63: Summary of Potential Risk to Ecological Receptors at Grove Pond and Plow Shop Pond, Fort Devens Superfund Site, Ayer, MA									
				Grove Pond			Plow Shop Pond		
Receptor Groups	Target Receptors	Exposure Scenarios	LOE[1]	Risk[2]	Risk COC[3]	WOE[4]	Risk	Risk COC	WOE
AQUATIC RECEPTORS									
Benthic Invertebrates	Generic	Maximum	A.1	H	Hg	L	H	Hg	L
		Average	A.1	H	Cr	L	H	Hg	L
		Bioassay	B.1	L[2.a]	-	M-H	H[2.c]	-	M-H
		Bioassay	B.2	L[2.b]	-	M-H	L[2.d]	-	M-H
		Field	C.1	L[2.e]	-	M	L[2.e]	-	M
Water Column Invertebrates[6]	Generic	Maximum	A.2	M	Mn	L	M	Ba	L
		Average	A.2	L	Ba	L	L	Ba	L
		Bioassay	B.3	N	-	M	N	-	M
Fish	Warm Water Fish Species Assemblage	Maximum	A.2	M	Mn	L	M	Ba	L
		Average	A.2	L	Ba	L	L	Ba	L
		Bioassay	B.4	N	-	M	N	-	M
		Field	C.2	L[2.f]	Cu	M	L[2.f]	Cu	M
WILDLIFE RECEPTORS[2.g]									
Omnivorous Mammals	Raccoon	FCM	A.3	N	Al	M-H	H[2.h]	As	M-H
Piscivorous Mammals	Mink	FCM	A.3	N	-	M-H	N	As	M-H
Carnivorous Birds	Black-Crowned Night Heron	FCM	A.3	M	Cr	M-H	L	Cr	M-H
Piscivorous Birds	Belted Kingfisher	FCM	A.3	N	-	M-H	M	MeHg	M-H
Insectivorous Birds	Tree Swallow	FCM	A.3	M	Cr	M-H	M	Cr	M-H

CBR = critical body residue
COC = contaminant of concern
EDD = estimate daily dose
FCM = food chain modeling
HQ = hazard quotient
LOE = line of evidence
LOEC = lowest observed effect concentration (for aquatic receptors)
LOAEL = lowest observed adverse effect level (for wildlife receptors)
TRV = toxicity reference value
WOE = weight of evidence

[1] LOE:
A.1 = Compare concentrations of COCs in sediment samples collected from the ponds to generic effect benchmarks
A.2 = Compare concentrations of COCs in surface water samples collected from the ponds to generic chronic benchmarks
A.3 = Compare the average EDD calculated using wildlife food chain modeling to a wildlife TRV_{effect}

B.1 = Assess the acute (10-day) toxicity of sediment collected from the ponds on survival and growth in the amphipod, *Hyalella azteca*

B.2 = Assess the acute (10-day) toxicity of sediment collected from the ponds on survival and growth in the midge-fly larvae, *Chironomus tentans*
B.3 = Assess the chronic (7-day) toxicity of surface water collected from the ponds on survival and reproduction in the water flea, *Ceriodaphnia dubia*
B.4 = Assess the subchronic (7-day) toxicity of surface water collected from the ponds on survival and growth in the fathead minnow, *Pimephales promelas*

C.1 = Compare average tissue residue levels of COCs in invertebrates collected from the ponds to invertebrate $CBRs_{effect}$
C.2 = Compare average whole body tissue residue levels of COCs in fish collected from the ponds to fish $CBRs_{effect}$

[2] Risk (see also additional footnotes below):
Y/H (black) = yes/high (potential risk is present for at least one COC at a LOEC, LOAEL, or CBR_{effect} HQ > 10 **OR** high toxicity is observed in laboratory bioassays)
Y/M (dark grey) = yes/moderate (potential risk is present for at least one COC at a LOEC, LOAEL, or CBR_{effect} HQ between 5 and 10 **OR** moderate toxicity is observed in laboratory bioassays)
Y/L (light grey) = yes/low (potential risk is present for at least one COC at a LOEC, LOAEL, or CBR_{effect} HQ between 1 and 5 **OR** low toxicity is observed in laboratory bioassays)
N (**crosshatch**) = no (no risk is present; all COCs have a LOEC, LOAEL, or CBR_{effect} HQ below 1 **OR** no significant toxicity is observed in laboratory bioassays)

[2.a] Low risk due to reduced growth (but no increased mortality) in *H. azteca* in one of three Grove Pond sediment samples
[2.b] Low risk due to reduced growth (but no increased mortality) in *C. tentans* in one of three Grove Pond sediment samples
[2.c] High risk due to reduced growth in *C. tentans* in five of 11 samples and increased mortality in one additional sample from Plow Shop Pond
[2.d] Low risk due to increased mortality in *C. tentans* in one of eleven Plow Shop Pond sediment samples, but no toxic response in the other 10 samples
[2.e] The potential risk from manganese (Mn) was high ($HQ_{average\text{-}LOAEL}$ = 16) for benthic invertebrates in both ponds. However, the CBRs for Mn had a low level of confidence because they were derived from unrelated species. None of the other COCs posed an unacceptable risk. Hence, the overall risk to benthic invertebrates was deemed low.
[2.f] The risk evaluation is for HQs based on comparing average whole body concentrations to LOAELs in six fish species (Grove Pond) or four species (Plow Shop Pond). The value shown for each pond is the highest risk across species.
[2.g] The wildlife risk shown in this table represents residual risk (site risk – background risk); the exception is tree swallows for which background risk was not available
[2.h] Site risk due to thallium was high ($HQ_{average\text{-}LOAEL}$ = 50), with no thallium detected in the reference pond. However, the risk score was not based on thallium because this compound does not represent a known site-related COC, whereas arsenic has been linked directly to Plow Shop Pond.

[3] Represents the COC with the highest HQ; a risk contaminant was not included if no risk was identified or if the LOE was based on laboratory toxicity tests or field surveys (Al = aluminum; As = arsenic; Ba = barium; Cr = chromium; Cu = copper; Hg = mercury; MeHg = methylmercury; Mn = manganese).

[4] WOE
L = Low WOE (generic surface water or sediment benchmarks; qualitative fish community survey)
M = Medium WOE (surface water toxicity testing; comparing measured tissue residues to CBRs)
M-H = Medium-high WOE (sediment toxicity testing; wildlife food chain modeling)

Appendix A
Data Summary Tables for Grove Pond

TABLE A-1
Grove Pond Surface Water Inorganics - Dissolved

				12/22/1993				8/25/1998				
Dissolved Metals	Max (ug/L)	Avg (ug/L)	Frequency of Detection	SW-1	SW-2	SW-3	SW-4	SW001F	SW002F	SW003F	SW004F	SW005F
Aluminum	110	23	5/18	<100	110	<100	<100	<10	<10	<10	<10	<10
Antimony	ND	ND	ND	<50	<50	<50	<50	<5	<5	<5	<5	<5
Arsenic	4	3	13/20	<5	<5	<5	<5	0.004	0.002	0.003	0.005	0.007
Barium	21	11	15/18	<10	<10	<10	10	11.8	7.2	7.4	11.3	14
Beryllium	ND	ND	ND	<5	<5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium	ND	ND	ND	<5	<5	<5	<5	<3	<3	<3	<3	<3
Calcium	27000	7347	18/18	6800	8200	8100	10000	18.7	18.4	18.5	18.8	19.1
Chromium	3.9	2	2/20	<10	<10	<10	<10	<3	<3	<3	<3	<3
Cobalt	4	3	5/18	<20	<20	<20	<20	<1.5	<1.5	<1.5	<1.5	<1.5
Copper	1.7	2	6/20	<10	<10	<10	<10	<1.5	<1.5	<1.5	<1.5	<1.5
Iron	350	100	18/18	50	140	90	40	0.33	0.16	0.17	0.4	0.8
Lead	0.39	7	3/20	<50	<50	<50	<50	<5	<5	<5	<5	<5
Magnesium	3100	1151	1818	1200	1500	1500	1600	3	3.1	3	3.1	3.1
Manganese	801	212	1818	70	60	30	70	383	118	142	484	801
Mercury	ND	ND	ND	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Molybdenum	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	1.4	5	6/20	<25	<25	<25	<25	<6	<6	<6	<6	<6
Potassium	780	161	9/12	780	<500	640	<500	1.4	1.4	1.6	1.5	1.7
Selenium	ND	ND	ND	<5	<5	<5	<5	<10	<10	<10	<10	<10
Silver	ND	ND	ND	<10	<10	<10	<10	<3	<3	<3	<3	<3
Sodium	22000	6105	1212	16000	22000	20000	15000	27.4	28.8	31.6	28.1	29.9
Thallium	ND	ND	ND	<5	<5	<5	<5	<40	<40	<40	<40	<40
Vanadium	ND	ND	ND	<10	<10	<10	<10	<1.5	<1.5	<1.5	<1.5	<1.5
Zinc	20	6	520	10	20	10	<10	<12	<12	<12	<12	<12

TABLE A-1
Grove Pond Surface Water Inorganics - Dissolved

		2/24/1999	11/18/1999		2/17/2000	11/3/2004					
Dissolved Metals	SW006F	SW008	SW-1 PDC	SW-2 PDC	SW-1	G1-2004	G2-2004	G3-2004	G4-2004	G5-2004	G6-2004
Aluminum	<10	<100	NA	NA	34.6	<5	<5	15	<5	6.2	6.4
Antimony	<5	<20	<30.0	<30.0	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Arsenic	0.008	0.001	<30.0	<30.0	<0.01	1.7	4	1.3	0.88	1	1.4
Barium	18.4	7.5	NA	NA	13.2	21	13	18	13	12	14
Beryllium	<0.5	<2	<5.0	<5.0	<0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cadmium	<3	<3	<10.0	<10.0	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Calcium	28	8.8	NA	NA	10.1	27000	21000	16000	11000	12000	12000
Chromium	<3	<3	<10.0	<10.0	<1.5	3.9	2.1	<0.5	<0.5	<0.5	<0.5
Cobalt	<1.5	<3	NA	NA	<1.5	<0.2	1.1	0.44	1.7	3.7	4
Copper	<1.5	<3	<10.0	<10.0	<1.5	1.7	1.4	0.52	0.95	0.66	0.73
Iron	0.28	0.0776	NA	NA	236	160	260	58	180	240	350
Lead	<5	<10	<20.0	<20.0	<5	0.39	0.24	<0.2	0.24	<0.2	<0.2
Magnesium	3.3	1.7	NA	NA	2.3	3100	2600	2200	2200	2400	2400
Manganese	280	18	NA	NA	166	130	540	46	50	120	310
Mercury	<0.5	NA	<1.0	<1.0	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Molybdenum	NA	NA	NA	NA	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel	<6	<6	<10.0	<10.0	<6	1.2	0.98	1.4	1.1	1.3	1.3
Potassium	1.9	<2	NA	NA	1.8	NA	NA	NA	NA	NA	NA
Selenium	<10	<10	<30.0	<30.0	<10	<1	<1	<1	<1	<1	<1
Silver	<3	<6	<20.0	<20.0	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sodium	45.4	22.1	NA	NA	46.9	NA	NA	NA	NA	NA	NA
Thallium	<40	<20	<30.0	<30.0	<100	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Vanadium	<1.5	<6	NA	NA	<1.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Zinc	<12	<6	<10.0	<10.0	10.1	<5	<5	<5	6.3	<5	<5

TABLE A-2
Grove Pond Surface Water Inorganics - Total Metals

Total Metals	Max (ug/L)	Avg (ug/L)	Frequency of Detection
Aluminum	176	44.9	14/20
Antimony	ND	ND	0/24
Arsenic	128	14.3	18/30
Barium	23	11.0	22/26
Beryllium	ND	ND	0/24
Cadmium	ND	ND	0/24
Calcium	27000	10536	26/26
Chromium	175	13.1	12/30
Cobalt	0.43	0.72	3/20
Copper	32	7.76	8/30
Iron	940	233	26/26
Lead	27	2.84	10/30
Magnesium	3100	1563	26/26
Manganese	1040	197	26/26
Mercury	1.1	0.40	1/23
Molybdenum	ND	ND	0/6
Nickel	32	4.36	7/24
Potassium	2000	970	19/20
Selenium	ND	ND	0/24
Silver	ND	ND	0/24
Sodium	27400	11895	20/20
Thallium	ND	ND	0/24
Vanadium	ND	ND	0/20
Zinc	9110	927	11/24

10/1/1992				
SW-A	SW-B	SW-C	SW-D	SW-E
<50.0	100	70	<50.0	<50.0
<3.0	<3.0	<3.0	<3.0	<3.0
<5.0	<5.0	<5.0	<5.0	<5.0
<10.0	10	<10.0	<10.0	10
<5.0	<5.0	<5.0	<5.0	<5.0
<1.0	<1.0	<1.0	<1.0	<1.0
13200	14600	14500	14600	18300
<5.0	<5.0	<5.0	<5.0	<5.0
<2.0	<2.0	<2.0	<2.0	<2.0
<40.0	<40.0	<40.0	<40.0	<40.0
190	310	190	130	260
<1.0	<1.0	<1.0	<1.0	<1.0
2000	2200	2200	2000	2100
40	90	10	70	60
<1.0	<1.0	<1.0	<1.0	<1.0
NA	NA	NA	NA	NA
<10.0	<10.0	<10.0	<10.0	<10.0
1000	2000	2000	1000	2000
<5.0	<5.0	<5.0	<5.0	<5.0
<20.0	<20.0	<20.0	<20.0	<20.0
16000	17000	16000	13000	13000
<1.0	<1.0	<1.0	<1.0	<1.0
<20.0	<20.0	<20.0	<20.0	<20.0
<50.0	<50.0	<50.0	<50.0	<50.0

TABLE A-2
Grove Pond Surface Water Inorganics - Total Metals

Total Metals			4/1/1995					
Aluminum	SW-F	SW-G	GRW-95-06X	GRW-95-07X	GRW-95-08X	GRW-95-09X	GRW-95-10X	GRW-95-11X
Antimony	<50.0	<50.0						
Arsenic	<3.0	<3.0						
Barium	<5.0	<5.0	<2.54	<2.54	3.94	<2.54	<2.54	<2.54
Beryllium	10	10	8	<5	9.25	7	8.5	6.37
Cadmium	<5.0	<5.0						
Calcium	<1.0	<1.0						
Chromium	14700	14100	10500	10600	13500	11200	13100	10900
Cobalt	<5.0	<5.0	<6.02	<6.02	39.8	8.43	<6.02	<6.02
Copper	<2.0	<2.0						
Iron	<40.0	<40.0	9.89	<8.09	<8.09	<8.09	<8.09	<8.09
Lead	120	100	222	228	402	249	181	238
Magnesium	<1.0	<1.0	<1.26	<1.26	2.39	3.04	<1.26	<1.26
Manganese	2000	1900	1950	1860	1970	1880	1990	1860
Mercury	20	20	46.6	97.4	100	58.4	39.3	73.8
Molybdenum	<1.0	<1.0						
Nickel	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	<10.0	<10.0						
Selenium	1000	1000	1210	1780	1670	1580	1730	1420
Silver	<5.0	<5.0						
Sodium	<20.0	<20.0						
Thallium	12000	12000	22400	22100	27400	24600	19100	23100
Vanadium	<1.0	<1.0						
Zinc	<20.0	<20.0						
	<50.0	<50.0						

TABLE A-2
Grove Pond Surface Water Inorganics - Total Metals

Total Metals	8/25/1998							8/12/1999		11/18/1999
Aluminum	SW001	SW002	SW003	SW004	SW005	SW006	SW008	PZ-1	PZ-2	PZ-1R
Antimony	176	24.4	21.3	32	43.1	122	<100			
Arsenic	<5	<5	<5	<5	<5	<5	<20	<15.0	<15.0	<15.0
Barium	0.005	0.004	0.003	0.009	0.006	0.01	0.001	62	128	102
Beryllium	14.2	9	7.7	18.5	11	22.3	7.6			
Cadmium	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<5.0	<5.0	<2.5
Calcium	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<3	<5.0	<5.0	<5.0
Chromium	20.5	20.1	20	20.3	20	30.5	8.8			
Cobalt	<3	<3	<3	<3	<3	31.5	<3	62	8	175
Copper	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<3			
Iron	<1.5	<1.5	<1.5	<1.5	<1.5	3.4	<3	<5.0	<5.0	<5.0
Lead	1.1	0.56	0.36	2	0.88	1.8	0.12			
Magnesium	<5	<5	<5	<5	<5	7.1	<10	27	<10.0	<10.0
Manganese	3.1	3	3	3.1	3.2	3.3	1.7			
Mercury	453	262	164	1040	459	389	18.2			
Molybdenum	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA	1.1	<1.0	<1.0
Nickel	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	<6	<6	<6	<6	<6	<6	<6	<5.0	<5.0	32
Selenium	1.4	1.3	1.5	1.6	1.6	1.8	<2			
Silver	<10	<10	<10	<10	<10	<10	<10	<15.0	<15.0	<15.0
Sodium	<3	<3	<3	<3	<3	<3	<6	<10.0	<10.0	<10.0
Thallium	26.2	27	29.5	26.8	28.5	43.1	22.4			
Vanadium	<40	<40	<40	<40	<40	<40	<20	<15.0	<15.0	<15.0
Zinc	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<6			
	17.1	<12	<12	<12	<12	<12	<6	9110	8640	2400

TABLE A-2
Grove Pond Surface Water Inorganics - Total Metals

Total Metals		11/3/2004					
Aluminum	PZ-2R	G1-2004	G2-2004	G3-2004	G4-2004	G5-2004	G6-2004
Antimony		19	10	48	13	27	18
Arsenic	<15.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Barium	98	2.3	4.6	1.1	1.3	1.4	1.9
Beryllium		23	13	18	15	14	15
Cadmium	<2.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Calcium	<5.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chromium		27000	21000	17000	12000	11000	12000
Cobalt	<5.0	20	5	1	0.8	0.8	0.8
Copper		<0.2	<0.2	0.28	<0.2	0.3	0.43
Iron	<5.0	3	32	3	1	3	2
Lead		390	500	130	620	650	940
Magnesium	<10.0	2	3.4	0.4	0.3	0.6	0.5
Manganese		3100	2500	2300	2200	2300	2300
Mercury		200	610	57	210	180	350
Molybdenum	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Potassium	<5.0	1.4	1.2	2.5	1.1	1.6	1.3
Selenium		NA	NA	NA	NA	NA	NA
Silver	<15.0	<1	<1	<1	<1	<1	<1
Sodium	<10.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium		NA	NA	NA	NA	NA	NA
Vanadium	<15.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	1820	6	8	8	8	8	7

TABLE A-3

Grove Pond Sediment Metals Concentrations in mg/kg dw

Summary Statistics

Chemical	Max (mg/kg)	Average (mg/kg)	Frequency of Detection
Aluminum	90000	10676	145/145
Antimony	12.1	11	2/120
Arsenic	910	79	149/158
Barium	470	83	126/143
Beryllium	14.1	1.17	39/135
Cadmium	730	18	90/151
Calcium	340000		
Chromium	52000	5859	150/155
Cobalt	70.0	14	95/140
Copper	13000	146	141/145
Iron	42800		
Lead	1760	263	149/157
Magnesium	5300		
Manganese	2500	597	148/148
Mercury	422	22	103/127
Methyl mercury	0.07044	0.021	10/10
Nickel	86	29	129/143
Potassium	4120		
Selenium	41.2	8	47/138
Silver	12.4	3.20	19/77
Sodium	7020		
Thallium	0.2	8.8[a]	10/118
Vanadium	140	32	118/141
Zinc	820	268	141/147

a. The average concentration for thallium is much higher than the maximum concentration because of the elevated detection limits. The average of the 10 detected values is 0.16 mg/kg, which is the value used in the food chain modeling.

	1/1/1992														
name	BM 1	BM 2	BM 3	BM 4	GRD-92-01X	GRD-92-02X	GRD-92-03X	GRD-92-04X	GRD-92-05X	MADEP A	MADEP B	MADEP C	MADEP D	MADEP E	MADEP F
Aluminum	5800	2800	5000	1800	4450	10900	8160	8540	6430	6250	4150	8450	59900	43400	22800
Antimony															
Arsenic	23.0	10.0	8.10	86.0	23.0	350	910	11.6	3.09	105	20.0	64.9	108	92.8	51.4
Barium	32.0	50.0			23.2	181	156	35.3	83.3	88.0	38.0	88.0	52.0	29.0	25.0
Beryllium										0.80		1.20	6.90	4.40	4.40
Cadmium		730				8.16				8.00	1.00	26.0	4.00	10.0	2.00
Calcium															
Chromium	1600		56.0		692	19900	26100	23.8		5300	687	2220	1680	1030	186
Cobalt		43.0			3.63	18.1		3.10		9.00	3.90	16.5	45.0	18.0	51.0
Copper	36.0	13000			15.5	79.9	98.6	13.0		37.0	13.0	32.0	51.0	45.0	34.0
Iron	12000	93.0	4100	3300	6620	25400	20000	9210	1180	14600	6300	14200	19600	40200	21100
Lead	100	620	14.0		50.0	390	38.8	27.0	4.26	155	41.0	150	140	115	52.0
Magnesium															
Manganese	130	0.39	78.0	280	68.6	783	313	55.3	1640	727	317	809	855	132	674
Mercury	3.10				2.00	260	420			45.0	4.00	5.00	2.00	1.10	3.00
Nickel					8.97	36.9	23.2	12.9		20.0	8.00	38.0	50.0	30.0	43.0
Potassium															
Selenium						3.99	4.44		3.19	1.60		1.40	2.50	3.00	2.90
Silver														2.00	
Sodium															
Thallium										0.20		0.10		0.10	0.20
Vanadium	8.00	6.60			11.2	43.6		13.0		22.0	9.00	34.0	51.0	37.0	12.0
Zinc	96.0	40.0	22.0	28.0	80.8	447	303	28.6		267	87.0	315	309	211	372
	10/1/1992							12/22/1993							
	SED-D	SED-E	SED-F	SED-G	SED-A	SED-B	SED-C	S-1	S-2	S-3	S-4	SW-2	SW-3	SW-4	
Aluminum	59900	43400	22800	36700	6250	4150	8450	5200	3300	5600	3900	2800	5000	1800	
Antimony	<0.03	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<100	<98	<100	<390	<170	<140	<700	
Arsenic	108	92.8	51.4	61.6	105	20.0	64.9	11.0	18.0	7.30	28.0	10.0	8.10	86.0	
Barium	52.0	29.0	25.0	19.0	88.0	38.0	88.0	31.0	93.0	27.0	63.0	50.0	<14	<70	
Beryllium	6.90	4.40	4.40	6.60	0.80	<0.5	1.20	<2.0	<2.0	<2.0	<7.8	<3.4	<2.8	<14	
Cadmium	4.00	10.0	2.00	3.00	8.00	1.00	26.0	<2.0	<2.0	<2.0	<7.8	<3.4	<2.8	<14	
Calcium	5650	6670	6660	6860	5320	2130	5730	680	960	150	9700	730	560	28000	
Chromium	1680	1030	186	229	5300	687	2220	13.0	9.50	7.30	87.0	150	56.0	<28	

TABLE A-3
Grove Pond Sediment Metals Concentrations in mg/kg dw

Cobalt	45.0	18.0	51.0	70.0	9.00	3.90	16.5	<4.0	<3.9	<4.0	<16	<6.8	<5.6	<28	
Copper	51.0	45.0	34.0	41.0	37.0	13.0	32.0	26.0	110	7.30	24.0	43.0	<5.6	<28	
Iron	19600	40200	21000	27000	14600	6300	14200	9200	20000	5900	9500	13000	4100	3300	
Lead	140	115	52.0	72.0	155	41.0	150	63.0	230	<10	39.0	93.0	14.0	<70	
Magnesium	690	680	790	830	750	580	970	1700	530	480	640	620	740	1400	
Manganese	855	132	674	332	727	317	809	120	120	65.0	240	87.0	78.0	280	
Mercury	2.00	1.10	3.00	3.00	45.0	4.00	5.00	<0.25	0.70	<0.25	<1.0	0.39	<0.36	<1.8	
Nickel	50.0	30.0	43.0	58.0	20.0	8.00	38.0	11.0	12.0	<10	<39	<17	<14	<70	
Potassium	300	200	400	300	300	100	200	370	320	<100	<390	<170	<140	<700	
Selenium	2.50	3.00	2.90	3.10	1.60	<0.5	1.40	<1.0	2.00	<1.0	<4.0	<1.7	<1.4	<7.1	
Silver	<2	2.00	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<7.8	<3.4	<2.8	<14	
Sodium	300	100	100	100	200	100	100	<100	<98	<100	<390	<170	<140	<700	
Thallium	<0.1	0.10	0.20	0.20	0.20	<0.1	0.10	<1.0	<1.0	<1.0	<4.0	<1.7	<1.4	<7.1	
Vanadium	51.0	37.0	12.0	14.0	22.0	9.00	34.0	11.0	19.0	7.30	16.0	6.60	<2.8	<14	
Zinc	309	211	372	433	267	87.0	315	31.0	69.0	19.0	24.0	40.0	22.0	28.0	
	4/1/1995														
	GRD-95-08X	GRD-95-09X	GRD-95-10X	GRD-95-11X	GRD-95-12X	GRD-95-13X	GRD-95-14X	GRD-95-15X	GRD-95-16X	GRD-95-17X	GRD-95-18X	GRD-95-19X	GRD-95-20X	GRD-95-21X	GRD-95-22X
Aluminum	3620	8640	12900	12400	4700	8540	8300	5910	14100	8160	7990	6470	7410	5300	6450
Antimony	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09
Arsenic	20.8	44.4	160	140	61.5	104	44.4	49.2	69.9	85.2	108	41.8	110	70.7	9.23
Barium	39.2	81.9	118	117	54.4	72.9	58.0	<5.18	88.2	<5.18	<5.18	<5.18	54.6	<5.18	33.5
Beryllium	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium	17.1	28.9	27.6	110	23.7	8.73	4.94	<0.7	<0.7	20.9	<0.7	18.7	<0.7	23.3	<0.7
Calcium	1680	2200	3770	5430	4510	4630	3090	4390	6360	4870	5950	6180	6400	3430	1710
Chromium	17.1	34.5	43.9	71.0	85.9	374	424	501	736	250	342	214	2680	621	35.3
Cobalt	5.50	18.5	53.4	39.4	14.5	18.8	16.0	<1.42	24.2	<1.42	<1.42	19.0	<1.42	16.2	4.44
Copper	38.2	46.4	50.2	70.9	35.1	30.2	32.6	42.3	41.3	37.0	24.8	21.6	38.8	18.1	10.5
Iron	10500	15500	29600	22100	8680	16300	11200	9720	19900	24300	11000	8850	19100	12300	16500
Lead	123	178	492	361	86.0	100	453	190	221	143	130	120	232	71.0	11.4
Magnesium	1340	3270	4410	3970	1180	1990	2240	<100	3940	2730	1610	1520	1860	1710	4320
Manganese	413	1040	912	859	503	769	80.6	337	366	449	688	322	792	468	145
Mercury	<0.05	<0.05	0.44	<0.05	1.12	4.91	1.11	1.54	2.18	1.72	11.0	0.77	2.07	1.65	<0.05
Methyl mercury															
Nickel	28.5	42.3	54.4	71.8	27.9	24.3	20.5	31.0	37.6	38.2	<1.71	22.2	20.9	27.7	19.3
Potassium	661	1170	1470	1930	<100	<100	650	<100	1230	<100	<100	<100	<100	<100	1330
Selenium	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	4.14	<0.25	<0.25	<0.25	<0.25
Sodium	424	1260	2430	4010	2460	3340	2260	3890	3760	5590	3900	3320	2650	2530	698
Thallium	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Vanadium	11.3	28.1	75.1	55.5	<3.39	<3.39	27.2	<3.39	65.9	<3.39	<3.39	<3.39	59.2	<3.39	15.3
Zinc	198	340	443	755	238	309	312	357	321	482	139	225	237	223	125
	4/1/1995 (Cont)														
	GRD-95-24X	GRD-95-25X	GRD-95-26X	GRD-95-27X	GRD-95-28X	GRD-95-29X	GRD-95-30X	GRD-95-31X	GRD-95-32X	GRD-95-33X	GRD-95-34X	GRD-95-35X	GRD-95-36X	GRD-95-37X	GRD-95-38X
Aluminum	8870	5000	5520	8730	3530	6490	2330	6010	4830	4390	6310	4690	3840	15400	3370
Antimony	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09
Arsenic	270	100	110	340	43.6	96.0	4.16	83.3	89.8	110	107	53.0	23.7	112	8.52
Barium	267	171	338	470	70.2	131	<5.18	259	313	186	189	70.9	33.9	180	13.4
Beryllium	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium	<0.7	<0.7	3.07	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	16.7	7.30	3.96	21.9	<0.7
Calcium	24300	65600	70400	86800	11200	67400	150	60600	109000	148000	62300	4280	1680	30400	732
Chromium	27700	22900	19800	40300	9980	20400	6.01	47100	49800	30500	20800	3610	465	22400	61.6
Cobalt	21.1	<1.42	12.3	<1.42	<1.42	<1.42	<1.42	<1.42	<1.42	<1.42	<1.42	9.52	5.30	37.3	<1.42
Copper	122	143	210	144	56.9	98.7	3.68	240	237	85.7	98.8	57.8	21.1	126	5.85
Iron	19300	8480	7780	15600	11300	18100	2370	19800	16300	9710	21400	13900	8090	24700	3050
Lead	782	682	423	739	313	563	3.29	1760	1150	387	578	262	74.8	748	7.85
Magnesium	2130	2060	2330	3260	908	1010	373	1930	1570	1420	<100	600	1240	1850	470
Manganese	1210	989	620	1260	411	476	26.5	1540	1730	1080	1190	380	243	1220	105
Mercury	86.0	4.32	16.0	227	2.78	69.0	<0.05	5.77	88.0	72.0	17.0	3.40	0.92	23.0	0.13
Methyl mercury				0.053					0.0059						
Nickel	41.9	18.7	25.3	19.7	21.1	18.0	3.95	35.3	<1.71	<1.71	45.4	22.4	12.8	59.7	4.23
Potassium	<100	<100	<100	<100	<100	724	<100	<100	<100	<100	<100	<100	487	<100	<100
Selenium	<0.25	<0.25	<0.25	3.02	<0.25	3.23	<0.25	<0.25	<0.25	<0.25	<0.25	2.10	<0.25	<0.25	<0.25
Sodium	3880	2270	1460	5120	3120	3060	466	6370	5130	3890	7020	2140	904	5200	698
Thallium	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Vanadium	111	60.4	62.6	66.0	30.0	58.6	<3.39	85.4	75.6	98.9	78.2	39.6	12.4	86.4	<3.39
Zinc	538	281	315	639	197	429	<8.03	474	356	316	549	241	103	654	19.1
	4/1/1995														
	GRD-95-40X	GRD-95-41X	GRD-95-42X	GRD-95-43X	GRD-95-44X	GRD-95-45X	GRD-95-46X	GRD-95-47X	GRD-95-48X	GRD-95-49X	GRD-95-50X	GRD-95-51X	GRD-95-52X	GRD-95-53X	GRD-95-54X

TABLE A-3
Grove Pond Sediment Metals Concentrations in mg/kg dw

Aluminum	9420	19300	90000	6730	20300	64300	66600	6530	3620	8180	9990	13700	9950	6360	7210
Antimony	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09
Arsenic	160	39.0	137	240	150	95.0	64.2	61.8	31.2	35.7	170	126	83.9	220	40.5
Barium	56.9	<5.18	<5.18	<5.18	34.2	<5.18	<5.18	<5.18	49.2	63.4	171	92.3	72.6	<5.18	47.2
Beryllium	<0.5	<0.5	<0.5	<0.5	<0.5	14.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium	9.30	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	8.25	<0.7	11.4	34.5	21.1	26.3	22.2
Calcium	6860	4400	5090	3860	1210	9510	3380	5240	2220	4620	116000	6810	6060	10500	5700
Chromium	562	728	3720	176	126	144	2010	1250	168	1260	20000	6650	1060	<4.05	213
Cobalt	<1.42	8.58	53.1	<1.42	<1.42	29.5	<1.42	19.6	7.93	<1.42	24.8	41.1	<1.42	<1.42	<1.42
Copper	23.6	20.5	137	23.9	76.6	54.5	68.8	37.2	41.5	32.8	88.6	67.7	41.5	69.0	26.0
Iron	22100	13100	17600	28400	42800	23300	10800	11300	6320	8240	18700	19300	14100	34200	10400
Lead	78.2	69.0	230	130	64.0	81.0	110	180	1130	146	530	366	150	323	73.0
Magnesium	1390	5300	<100	1010	1060	<100	<100	<100	658	1690	1620	1780	2040	1870	2150
Manganese	709	110	885	204	657	35.0	53.6	625	282	152	994	634	655	1030	378
Mercury	1.34	1.05	2.56	0.47	422	<0.05	0.87	9.58	0.68	5.28	90.0	24.0	12.6	<0.05	0.50
Methyl mercury											0.056		0.013		
Nickel	31.2	24.8	69.9	<1.71	<1.71	38.3	34.1	26.7	19.3	<1.71	47.0	58.3	39.6	45.2	33.9
Potassium	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	1360	<100	<100	<100
Selenium	<0.25	2.04	<0.25	<0.25	7.80	<0.25	<0.25	3.66	<0.25	<0.25	<0.25	<0.25	4.37	<0.25	<0.25
Sodium	2670	1380	5820	2600	1850	3690	3350	3240	1580	2920	4580	4410	3950	5340	2230
Thallium	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Vanadium	<3.39	32.1	<3.39	<3.39	25.7	<3.39	59.9	<3.39	<3.39	35.0	87.5	66.3	<3.39	<3.39	<3.39
Zinc	188	72.3	448	84.6	<8.03	150	134	240	216	154	547	577	350	648	274
	4/1/1995														
	GRS-95-01X	GRS-95-02X	GRS-95-03X	GRS-95-04X	GRS-95-05X	GRS-95-06X	GRS-95-07X	GRS-95-08X	GRS-95-09X	GRS-95-10X	GRS-95-11X	GRS-95-12X	GRS-95-13X	GRS-95-14X	GRS-95-15X
Aluminum	5540	3710	3160	4340	4500	5130	3850	4360	1320	17100	19300	7240	7140	8420	9520
Antimony	<1.09	<1.09	<1.09	<1.09	<1.09	12.1	5.70	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09
Arsenic	11.6	9.18	8.40	8.75	6.80	22.0	99.0	14.0	3.89	8.85	15.2	20.0	12.0	17.0	20.0
Barium	14.0	14.1	25.9	11.7	7.64	192	35.7	10.2	<5.18	63.6	204	17.8	29.7	14.7	21.2
Beryllium	<0.5	0.64	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.90	<0.5	<0.5	<0.5	<0.5
Cadmium	<0.7	1.22	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Calcium	911	466	687	277	155	2200	498	128	5750	1530	24600	273	1120	221	495
Chromium	22.1	10.3	26.1	8.46	6.80	19.7	16.9	7.58	<4.05	<4.05	23.7	23.6	19.7	25.8	24.4
Cobalt	4.23	3.49	2.29	3.20	2.38	5.20	3.57	<1.42	<1.42	18.4	7.56	3.09	<1.42	3.36	4.76
Copper	5.79	6.06	7.95	10.1	4.13	175	54.7	5.95	9.56	108	52.9	8.68	7.95	7.22	8.65
Iron	8540	5560	6230	6210	4510	24100	15700	5330	2790	5550	19300	11400	12700	11600	10100
Lead	14.0	11.0	47.9	12.0	4.22	538	143	11.0	199	482	598	21.1	84.0	44.8	12.0
Magnesium	3320	1330	763	1160	787	920	906	559	<100	<100	1060	3310	1590	3160	3190
Manganese	102	167	119	85.6	41.3	192	72.6	26.9	108	72.0	242	141	157	107	144
Mercury	<0.05	<0.05	0.15	<0.05	<0.05	0.43	0.60	<0.05	0.34	<0.05	<0.05	<0.05	0.17	<0.05	<0.05
Nickel	22.5	11.0	8.10	8.39	7.99	14.2	9.90	5.46	<1.71	22.5	11.2	17.2	11.1	18.6	24.7
Potassium	429	470	279	284	188	515	322	158	1000	1200	1460	303	307	443	741
Selenium	<0.25	<0.25	0.69	0.42	<0.25	2.29	1.36	0.58	<0.25	<0.25	<0.25	0.43	<0.25	<0.25	<0.25
Silver	<0.589	0.79	<0.589	<0.589	<0.589	<0.589	<0.589	<0.589	<0.589	<0.589	<0.589	<0.589	<0.589	<0.589	<0.589
Sodium	418	297	374	305	301	517	493	369	1660	1610	1050	347	619	387	314
Vanadium	17.5	8.94	35.6	8.08	6.36	29.8	28.6	14.2	<3.39	<3.39	34.5	19.0	20.9	25.2	20.6
Zinc	19.9	38.5	14.7	16.3	<8.03	96.6	34.4	<8.03	49.9	<8.03	43.6	20.6	28.4	22.9	26.2
	9/11/1998				8/1/1999										
	GSEM-1	GSEM-2	GSEM-3	GSEM-4	1SC1	1SC2	1SC3	3SC2	3SC3	4SC1	5SC2	6SC1	8SC1	BHSO3	
Aluminum	1.40	1.10	0.54	2.10	10100	10700	11500	5720	5980	4600	4210	4660	5030	2390	
Antimony	<5	<5	<5	<5	<10.0	<10	<10	<10	<10	<10.0	<10.0	<10.0	<10	<5	
Arsenic	90.0	100	50.0	120	<50	<90	<90	<20	<20	<20	<20	<20	<20.0	10.0	
Barium	115	90.3	170	73.0	93.4	88.1	82.0	19.8	22.8	10.8	15.3	7.40	13.8	16.6	
Beryllium	1.20	1.00	0.95	3.10	1.30	1.20	0.95	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	
Cadmium	8.70	23.2	6.80	12.6	8.80	53.1	15.8	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	1.50	
Calcium	0.57	0.59	21.5	0.51	10300	6820	6280	1110	1120	633	1050	400	973	414	
Chromium	59.7	337	33400	3510	64.9	184	167	10.2	14.0	10.8	9.50	10.9	11.7	7.10	
Cobalt	34.0	28.8	3.50	42.5	12.1	23.7	24.9	<3.0	5.30	<3.0	<3.0	3.40	5.00	3.00	
Copper	64.5	43.2	88.0	52.5	19.3	43.5	39.1	3.00	5.10	<3.0	<3.0	4.60	6.30	3.80	
Iron	2.20	2.10	0.87	2.00	12600	19300	18800	5020	6830	6040	4700	7230	7720	5500	
Lead	304	166	386	238	53.1	185	127	<20	<20	<20	<20	<20.0	<20	20.0	
Magnesium	3880	2240	1650	1430	1520	2320	2470	1520	2050	1690	1310	2190	1310	1190	
Manganese	789	861	1080	366	1280	1180	965	72.8	91.7	76.7	60.5	64.7	85.1	362	
Nickel	61.2	41.6	15.2	63.1	24.6	46.5	40.1	10.9	21.3	12.6	10.6	15.2	15.0	14.4	
Potassium	1720	1020	682	682	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	433	
Selenium	10.2	10.3	10.4	10.1	<20	<20	<20	<20	<20	<20	<20.0	<20	<20	20.0	
Silver	2.00	2.00	2.00	2.00	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	6.00	
Sodium	492	485	753	288	1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	100	

TABLE A-3
Grove Pond Sediment Metals Concentrations in mg/kg dw

Thallium	20.4	20.6	20.9	20.2	<20	<20	<20	<20	<20	<20	<20.0	<20	<20	<20	
Vanadium	45.4	31.6	53.5	43.0	16.1	32.8	25.7	6.00	6.70	5.70	5.10	5.50	8.00	6.00	
Zinc	632	380	297	472	159	398	363	17.6	25.5	17.6	16.5	20.7	25.2	14.5	
	8/1/1999														
	SD-01	SD-02	SD-02DUP	SD-03	SD-04	SD-05	SD-06	SD-07	SD-08	SD-09	SD-10				
Aluminum	5150	11100	11500	12800	11300	11400	9240	6030	10300	8090	11700				
Antimony	<14	<36	<21	<30	<37	<39	<34	<20	<41	<15	<33				
Arsenic	25.0	110	125	90.0	80.0	100	120	45.0	120	35.0	90.0				
Barium	34.2	92.5	96.8	97.0	86.1	81.6	99.5	44.4	85.8	43.6	82.1				
Beryllium	0.71	1.80	1.20	1.50	1.80	1.90	1.70	1.00	2.10	0.73	1.70				
Cadmium	10.0	51.0	49.0	8.00	7.00	13.0	7.00	4.00	24.0	12.0	22.0				
Calcium	3650	8680	6380	6300	6320	6130	11700	4370	6960	3130	5610				
Chromium	94.1	284	340	284	153	198	5610	482	1000	219	213				
Cobalt	6.00	31.0	33.0	23.4	18.8	24.7	8.30	6.80	28.4	8.30	24.1				
Copper	16.4	52.8	52.6	33.3	33.6	37.2	124	21.6	81.1	17.7	37.9				
Iron	5780	22200	24500	20200	15300	20100	24300	8720	21800	8860	18000				
Lead	75.8	235	251	114	123	147	277	80.5	221	79.8	223				
Magnesium	831	2470	2560	2640	2220	2490	3060	1020	2170	1250	2670				
Manganese	237	1020	1090	1270	1080	857	284	595	1060	622	870				
Nickel	14.0	50.4	51.9	26.0	24.3	30.1	27.5	14.2	43.0	16.9	35.8				
Potassium	1420	3590	2080	3010	3660	3870	3420	2010	4120	1460	3300				
Selenium	14.2	35.9	20.8	30.1	36.6	38.7	34.2	20.1	41.2	14.6	33.0				
Silver	4.20	10.8	6.20	9.00	11.0	11.6	10.2	6.00	12.4	4.40	9.90				
Sodium	1420	3590	2080	3010	3660	3870	3420	2010	4120	1460	3300				
Thallium	<28.3	<71.7	<41.7	<60.2	<73.2	<77.4	<68.3	<40.1	<82.4	<29.2	<65.9				
Vanadium	17.9	38.4	39.7	26.7	27.1	30.4	40.4	14.1	34.2	16.5	31.5				
Zinc	137	532	512	229	257	332	369	106	431	133	354				
	9/1/2000			1/1/2001											
	GPCORE1	GPCORE2	GPCORE3	GV1	GV10	GV2	GV3	GV4	GV5	GV6	GV7	GV8	GV9		
Arsenic	93.1	93.1	71.3	100.63	5.49	47.5	39.6	76.2	135.13	81.7	122.2	73.5	68.6		
Cadmium	17.0	17.0	10.2	58.0	0.49	21.0	11.4	9.95	4.71	10.9	2.02	3.16	6.44		
Chromium	1934.5	1934.5	19743.71	57.4	31.4	87.2	303.68	1408.25	8175.49	1608.58	26258.39	28831.01	2152.71		
Copper	42.0	42.0	113.11												
Lead	159.33	159.33	549.58	369.07	8.58	92.5	57.1	107.51	239.17	108.1	704.7	726.67	85.2		
Manganese	504.62	504.62	1081.62												
Mercury	0.56	13.8	10.9	0.34	0.025	0.23	2.14	15.2	73.5	25.7	28.4	11.8	26.8		
Methyl mercury				0.0021	0.00028	0.0024	0.0092	0.016	0.070	0.042	0.038	0.0100	0.025		
Nickel	35.1	35.1	34.0												
Zinc	275	275	306.62												
	3/1/2004														
	GP01	GP02	GP03	GP04	GP05	GP06	GP07	GP08	GP09	GP10	GP11	GP12	GP13	GP14	GP15
Aluminum	16000	13000	12000	12000	9800	8200	12000	9200	38000	9700	9800	17000	11000	9500	11000
Antimony	<10	<18	<26	<38	<22	<10	<17	<18	<14	<15	<20	<50	<49	<50	<55
Arsenic	95.0	140	96.0	130	90.0	79.0	77.0	95.0	66.0	86.0	95.0	130	370	130	100
Barium	140	98.0	97.0	130	78.0	76.0	81.0	86.0	23.0	86.0	81.0	220	200	300	390
Beryllium	1.30	<1.8	<2.6	<3.8	<2.2	1.00	<1.7	<1.8	5.80	<1.5	<2	<5	<4.9	<5	<5.5
Cadmium	38.0	95.0	76.0	130	59.0	39.0	15.0	46.0	6.30	34.0	37.0	19.0	<15	<15	<16
Calcium	4800	5900	5800	7500	6900	6100	5200	7300	7200	5400	6600	12000	11000	20000	55000
Chromium	48.0	76.0	38.0	220	1500	690	2200	1100	620	2400	1600	25000	20000	40000	52000
Cobalt	23.0	54.0	30.0	40.0	23.0	23.0	21.0	24.0	45.0	25.0	22.0	33.0	16.0	<15	<16
Copper	68.0	92.0	69.0	79.0	58.0	88.0	51.0	54.0	45.0	54.0	50.0	140	98.0	200	230
Iron	34000	30000	23000	30000	19000	21000	22000	23000	20000	22000	22000	31000	29000	26000	21000
Lead	190	380	200	310	230	160	260	180	61.0	190	230	870	460	1400	1600
Magnesium	5200	3700	3000	3000	1900	1700	2300	1900	840	1400	1800	2100	1600	3000	4100
Manganese	1200	960	1800	1600	640	670	400	940	70.0	1100	570	770	560	1100	1400
Mercury	0.38	0.49	0.32	0.96	5.40	6.80	5.70	3.10	0.62	8.30	6.20	18.0	340	15.0	4.80
Nickel	57.0	86.0	69.0	85.0	56.0	66.0	43.0	49.0	54.0	52.0	54.0	69.0	33.0	60.0	42.0
Potassium	1700	<1800	<2600	<3800	<2200	<1000	<1700	<1800	<1400	<1500	<2000	<5000	<4800	<5000	<5600
Selenium	<20	<36	<52	<76	<44	<20	<34	<36	<28	<30	<40	<100	<98	<100	<55
Silver	<3		<7.8	<11	<6.6	<3	<5.1	<5.4	<4.2	<4.5	<6	<15	<15	<15	<16
Sodium	<1000	<1800	<2600	<3800	<2200	1100	<1700	2000	<1400	1500	<2000	<5000	<4800	<5000	<5600
Thallium	<20	<36	<52	<76	<44	<20	<34	<36	<28	<30	<40	<100	<98	<100	<110
Vanadium	42.0	59.0	40.0	50.0	43.0	35.0	66.0	34.0	22.0	40.0	63.0	120	63.0	140	140
Zinc	500	700	720	820	550	480	450	550	330	570	550	770	570	580	550

TABLE A-3
Grove Pond Sediment Metals Concentrations in mg/kg dw

	2/2/2005		
	G-SED-1	G-SED-2	G-SED-3
Aluminum	13000	3100	5800
Antimony	<8.3	<7.5	<14
Arsenic	110	25.0	56.0
Barium	89.0	120	260
Beryllium	1.20	<0.75	<1.4
Cadmium	8.30	<2.2	4.40
Calcium	12000	340000	170000
Chromium	4600	11000	38000
Cobalt	20.0	<2.2	4.20
Copper	50.0	45.0	240
Iron	18000	3800	13000
Lead	260	340	1400
Magnesium	1900	1500	2400
Manganese	500	970	2500
Mercury	36.0	5.30	5.80
Nickel	34.0	6.00	25.0
Potassium	910	<380	880
Selenium	17.0	<15	<28
Silver	<2.5	<2.2	<4.2
Sodium	630	880	1300
Thallium	<50	<15	<60
Vanadium	31.0	47.0	81.0
Zinc	310	110	310

TABLE A-4
Grove Pond Sediments PAHs
Concentrations in mg/kg dw

Summary Statistics

Analyte	Max (mg/kg)	Avg (mg/kg)	Frequency of Detection
1-Methyl naphthalene	1.1	0.64	1/15
2-Methylnaphthalene	0	0.25	4/74
Acenaphthene	0.068	0.27	4/26
Acenaphthylene	0.22	0.15	5/78
Anthracene	0	0.19	8/78
Benzo(a)anthracene	3.4	0.45	7/78
Benzo(a)pyrene	1.1	0.47	6/26
Benzo(b)fluoranthene	2.4	0.44	4/70
Benzo(ghi)perylene	1.4	0.45	5/28
Benzo(k)fluoranthene	4.9	0.32	8/78
Chrysene	3.7	0.40	9/78
Dibenzo(a,h)anthracene	0.3	0.28	4/4
Fluoranthene	7.1	0.58	16/78
Fluorene	1.1	0.16	5/78
Indeno(1,2,3-cd)pyrene	1.6	0.54	4/26
Naphthalene	20	0.75	16/78
Phenanthrene	4.6	0.40	15/78
Pyrene	6	0.64	20/78
Total PAH	42.01	5.52	NA

	(ABB-ES, Oct. 1995)											
Analyte	GRD-95-08X	GRD-95-09X	GRD-95-10X	GRD-95-11X	GRD-95-12X	GRD-95-13X	GRD-95-14X	GRD-95-14Xdup	GRD-95-15X	GRD-95-16X	GRD-95-17X	GRD-95-18X
1-Methyl naphthalene												
2-Methylnaphthalene	< 1	< 0.5	< 1	< 1	4	< 0.2	< 0.2	< 0.2	< 0.049	< 0.2	< 0.2	< 0.2
Acenaphthene												
Acenaphthylene	< 0.7	< 0.3	< 0.7	< 0.7	< 0.2	< 0.2	< 0.2	< 0.2	< 0.033	< 0.2	< 0.2	< 0.2
Anthracene	< 0.7	< 0.3	< 0.7	< 0.7	< 0.2	< 0.2	< 0.2	< 0.2	2.4	< 0.2	< 0.2	< 0.2
Benzo(a)anthracene	< 3	< 2	< 3	< 3	< 0.8	< 0.8	< 0.8	< 0.8	3.4	< 0.8	< 0.8	< 0.8
Benzo(a)pyrene												
Benzo(b)fluoranthene	< 4	< 2	< 4	< 4	< 1	< 1	< 1	< 1	< 0.21	< 1	< 1	< 1
Benzo(ghi)perylene												
Benzo(k)fluoranthene	< 1	< 0.7	< 1	< 1	< 0.3	< 0.3	< 0.3	< 0.3	2.2	< 0.3	< 0.3	< 0.3
Chrysene	< 2	< 1	< 2	< 2	< 0.6	< 0.6	< 0.6	< 0.6	3.7	< 0.6	< 0.6	< 0.6
Dibenzo(a,h)anthracene												
Fluoranthene	5	< 0.7	< 1	< 1	< 0.3	< 0.3	2	< 0.3	3.7	< 0.3	< 0.3	< 0.3
Fluorene	< 0.7	< 0.3	< 0.7	< 0.7	< 0.2	< 0.2	< 0.2	< 0.2	1.1	< 0.2	< 0.2	< 0.2
Indeno(1,2,3-cd)pyrene												
Naphthalene	< 0.7	< 0.4	< 0.7	< 0.7	< 0.2	< 0.2	< 0.2	< 0.2	< 0.037	< 0.2	< 0.2	< 0.2
Phenanthrene	3	< 0.3	< 0.7	< 0.7	< 0.2	< 0.2	< 0.2	< 0.2	2.7	< 0.2	< 0.2	< 0.2
Pyrene	5	2	< 0.7	< 0.7	< 0.2	< 0.2	< 0.2	< 0.2	3.9	< 0.2	< 0.2	< 0.2
Total PAH	19.9	6.25	8.1	8.1	6.1	2.2	4.05	2.2	23.485	2.2	2.2	2.2

Analyte	GRD-95-19X	GRD-95-20X	GRD-95-21X	GRD-95-22X	GRD-95-23X	GRD-95-24X	GRD-95-24Xdup	GRD-95-25X	GRD-95-26X	GRD-95-27X	GRD-95-28X	GRD-95-32DupX
1-Methyl naphthalene												
2-Methylnaphthalene	< 0.1	< 0.1	< 0.049	< 2	< 0.1	< 0.049	< 0.049	< 0.049	< 0.049	< 0.2	< 0.2	< 0.2
Acenaphthene												
Acenaphthylene	< 0.07	< 0.07	< 0.033	< 1	< 0.07	< 0.033	< 0.033	< 0.033	< 0.033	< 0.2	< 0.2	< 0.2
Anthracene	< 0.07	< 0.07	< 0.033	< 1	< 0.07	< 0.033	< 0.033	< 0.033	< 0.033	< 0.2	< 0.2	< 0.2
Benzo(a)anthracene	< 0.3	< 0.3	< 0.17	< 7	< 0.3	< 0.17	< 0.17	< 0.17	< 0.17	< 0.8	< 0.8	< 0.8
Benzo(a)pyrene												
Benzo(b)fluoranthene	< 0.4	< 0.4	< 0.21	< 8	< 0.4	< 0.21	< 0.21	< 0.21	< 0.21	< 1	< 1	< 1
Benzo(ghi)perylene												
Benzo(k)fluoranthene	< 0.1	< 0.1	< 0.066	< 3	< 0.1	< 0.066	< 0.066	< 0.066	< 0.066	< 0.3	< 0.3	< 0.3
Chrysene	< 0.2	< 0.2	< 0.12	< 5	< 0.2	< 0.12	< 0.12	< 0.12	< 0.12	< 0.6	< 0.6	< 0.6
Dibenzo(a,h)anthracene												
Fluoranthene	< 0.1	< 0.1	< 0.068	< 3	< 0.1	< 0.068	< 0.068	0.068	0.73	< 0.3	< 0.3	< 0.3
Fluorene	< 0.07	< 0.07	< 0.033	< 1	< 0.07	< 0.033	< 0.033	< 0.033	< 0.033	< 0.2	< 0.2	< 0.2
Indeno(1,2,3-cd)pyrene												
Naphthalene	< 0.07	< 0.07	< 0.037	< 1	< 0.07	< 0.037	< 0.037	0.037	0.37	20	< 0.2	< 0.2
Phenanthrene	< 0.07	< 0.07	< 0.033	< 1	< 0.07	< 0.033	< 0.033	0.033	0.33	2	< 0.2	< 0.2
Pyrene	< 0.07	0.8	< 0.033	< 1	< 0.07	< 0.033	< 0.033	0.033	0.56	3	< 0.2	< 0.2
Total PAH	0.81	1.575	0.441	17	0.81	0.441	0.441	0.441	2.347	26.9	2.2	2.2

Analyte	GRD-95-33X	GRD-95-34X	GRD-95-35X	GRD-95-36X	GRD-95-37X	GRD-95-38X	GRD-95-39X	GRD-95-40X	GRD-95-41X	GRD-95-42X	GRD-95-43X	GRD-95-44X
1-Methyl naphthalene												
2-Methylnaphthalene	< 0.2	< 0.2	2	0.72	< 0.1	< 0.2	< 0.1	< 0.049	< 0.049	< 0.049	< 0.1	< 0.049
Acenaphthene												
Acenaphthylene	< 0.2	< 0.2	< 0.2	0.18	< 0.07	< 0.2	< 0.07	< 0.033	< 0.033	< 0.033	< 0.07	< 0.033
Anthracene	< 0.2	< 0.2	< 0.2	0.12	< 0.07	< 0.2	< 0.07	< 0.033	< 0.033	< 0.033	< 0.07	< 0.033
Benzo(a)anthracene	< 0.8	< 0.8	< 0.8	< 0.17	< 0.3	< 0.8	< 0.3	< 0.17	< 0.17	< 0.17	< 0.3	< 0.17
Benzo(a)pyrene												
Benzo(b)fluoranthene	< 1	< 1	< 1	< 0.21	< 0.4	< 1	< 0.4	< 0.21	< 0.21	< 0.21	< 0.4	< 0.21
Benzo(ghi)perylene												
Benzo(k)fluoranthene	< 0.3	< 0.3	< 0.3	< 0.066	< 0.1	< 0.3	< 0.1	< 0.066	< 0.066	< 0.066	< 0.1	< 0.066
Chrysene	< 0.6	< 0.6	< 0.6	0.43	< 0.2	< 0.6	< 0.2	< 0.12	< 0.12	< 0.12	< 0.2	< 0.12
Dibenzo(a,h)anthracene												
Fluoranthene	< 0.3	< 0.3	2	0.66	< 0.1	< 0.3	< 0.1	< 0.068	< 0.068	< 0.068	< 0.1	< 0.068
Fluorene	< 0.2	< 0.2	< 0.2	< 0.033	< 0.07	< 0.2	< 0.07	< 0.033	< 0.033	< 0.033	< 0.07	< 0.033
Indeno(1,2,3-cd)pyrene												
Naphthalene	7	< 0.2	3	0.57	< 0.07	< 0.2	< 0.07	< 0.037	< 0.037	< 0.037	< 0.07	< 0.037
Phenanthrene	< 0.2	< 0.2	1	0.44	< 0.07	< 0.2	< 0.07	< 0.033	< 0.033	< 0.033	< 0.07	< 0.033
Pyrene	< 0.2	< 0.2	2	0.45	< 0.07	< 0.2	< 0.07	< 0.033	< 0.033	< 0.033	< 0.07	< 0.033
Total PAH	9.1	2.2	11.65	3.8095	0.81	2.2	0.81	0.4425	0.458	0.461	0.81	0.4425

TABLE A-4
Grove Pond Sediments PAHs
Concentrations in mg/kg dw

Analyte	GRD-95-45X	GRD-95-46X	GRD-95-47X	GRD-95-48X	GRD-95-49X	GRD-95-50X	GRD-95-51X	GRD-95-52X	GRD-95-53X	GRD-95-54X	GRD-95-55X
1-Methyl naphthalene											
2-Methylnaphthalene	< 0.049	< 0.049	< 0.1	< <0.1	< <0.049	< <0.049	< <0.049	< <0.049	< 0.049	< 0.049	< 0.049
Acenaphthene											
Acenaphthylene	< 0.033	< 0.033	< 0.07	< <0.07	< <0.033	< <0.033	< <0.033	< <0.033	< 0.033	< 0.033	< 0.033
Anthracene	< 0.033	< 0.033	< 0.07	< <0.07	< <0.033	< <0.033	< <0.033	< <0.033	< 0.033	< 0.033	< 0.033
Benzo(a)anthracene	< 0.17	< 0.17	< 0.3	< <0.3	< <0.17	< <0.17	< <0.17	< <0.17	< 0.17	< 0.17	< 0.17
Benzo(a)pyrene											
Benzo(b)fluoranthene	< 0.21	< 0.21	< 0.4	< <0.4	< <0.21	< <0.21	< <0.21	< <0.21	< 0.21	< 0.21	< 0.21
Benzo(ghi)perylene											
Benzo(k)fluoranthene	< 0.066	< 0.066	< 0.1	< <0.1	< <0.066	< <0.066	< <0.066	< <0.066	< 0.066	< 0.066	< 0.066
Chrysene	< 0.12	< 0.12	< 0.2	< <0.2	< <0.12	< <0.12	< <0.12	< <0.12	< 0.12	< 0.12	< 0.12
Dibenzo(a,h)anthracene											
Fluoranthene	< 0.068	< 0.068	< 0.1	< <0.1	< <0.068	< <0.068	< <0.068	< <0.068	< 0.068	< 0.068	< 0.068
Fluorene	< 0.033	< 0.033	< 0.07	< <0.07	< <0.033	< <0.033	< <0.033	< <0.033	< 0.033	< 0.033	< 0.033
Indeno(1,2,3-cd)pyrene											
Naphthalene	< 0.037	< 0.037	< 0.07	< <0.07	< <0.037	1.1	< <0.037	< <0.037	< 0.037	< 0.037	< 0.037
Phenanthrene	< 0.033	< 0.033	< 0.07	< <0.07	< <0.033	< <0.033	< <0.033	< <0.033	< 0.033	< 0.033	< 0.033
Pyrene	< 0.033	< 0.033	< 0.07	< <0.07	0.42	0.62	< <0.033	< <0.033	< 0.033	< 0.033	< 0.033
Total PAH	0.4425	0.4425	0.81	0.81	0.846	2.1275	0.4425	0.4425	0.4425	0.4425	0.4425

	Collected 2/2/05			Collected 12/22/93				10/2/1992						
Analyte	G-SED-1	G-SED-2	G-SED-3	S-1	S-2	S-3	S-4	SED-A	SED-B	SED-C	SED-D	SED-E	SED-F	SED-G
1-Methyl naphthalene				< 0.7	1.1	< 0.7	< 4.2	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
2-Methylnaphthalene				< 0.18	0.88	< 0.18	< 1.1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Acenaphthene	0.068	0.034	0.022	< 0.28	< 0.28	< 0.28	< 1.7	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Acenaphthylene	0.22	0.046	0.079	< 0.26	< 0.26	< 0.26	< 1.6	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Anthracene	0.37	0.11	0.13	< 0.24	< 0.24	< 0.24	< 1.4	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Benzo(a)anthracene	1	0.21	0.33	< 0.32	0.78	< 0.32	< 1.9	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Benzo(a)pyrene	1.1	0.19	0.37	< 0.38	0.61	< 0.38	< 2.3	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Benzo(b)fluoranthene	2.4	0.36	0.61					< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Benzo(ghi)perylene	1.3	0.028	0.084	< 0.5	< 0.5	< 0.5	< 3	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Benzo(k)fluoranthene	0.65	0.11	0.21	< 0.36	1.7	< 0.36	< 2.2	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chrysene	1.7	0.35	0.43	< 0.32	1.1	< 0.32	< 1.9	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Dibenzo(a,h)anthracene	0.3	0.052	0.03	< 0.48	< 0.48	< 0.48	< 2.9	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Fluoranthene	3.1	0.78	0.84	< 0.28	1.4	< 0.28	< 1.7	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Fluorene	0.25	0.084	0.069	< 0.28	< 0.28	< 0.28	< 1.7	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Indeno(1,2,3-cd)pyrene	1.1	< 0.009	0.037	< 0.48	< 0.48	< 0.48	< 2.9	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Naphthalene	2.1	0.28	2.7	< 0.22	< 0.22	< 0.22	< 1.3	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Phenanthrene	1.5	0.6	0.43	< 0.26	1.4	< 0.26	< 1.6	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Pyrene	2.3	0.59	0.73	< 0.28	1.2	< 0.28	< 1.7	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Total PAH	19.458	3.8285	7.101	2.91	13.08	2.91	17.55	4.5	4.5	4.5	4.5	4.5	4.5	4.5

4/29/1994							
Analyte	SEDIMENT 1	SEDIMENT 2	SEDIMENT 3	SEDIMENT 4	SEDIMENT 5	SEDIMENT 6	SEDIMENT 7
1-Methyl naphthalene							
2-Methylnaphthalene	< 0.55	< 0.4	< 0.45	< 0.33	< 0.62	< 2	< 0.35
Acenaphthene	< 0.55	< 0.4	< 0.45	< 0.33	< 0.62	< 2	< 0.35
Acenaphthylene	< 0.55	< 0.4	< 0.45	< 0.33	< 0.62	< 2	< 0.35
Anthracene	< 0.55	< 0.4	< 0.45	< 0.33	< 0.62	< 2	< 0.35
Benzo(a)anthracene	< 0.55	< 0.4	< 0.45	< 0.33	< 0.62	< 2	< 0.35
Benzo(a)pyrene	< 0.55	< 0.4	< 0.45	< 0.33	< 0.62	< 2	< 0.35
Benzo(b)fluoranthene	< 0.55	< 0.4	< 0.45	< 0.33	< 0.62	< 2	< 0.35
Benzo(ghi)perylene	< 0.55	< 0.4	< 0.45	< 0.33	< 0.62	< 2	< 0.35
Benzo(k)fluoranthene	< 0.55	< 0.4	< 0.45	< 0.33	< 0.62	< 2	< 0.35
Chrysene	< 0.55	< 0.4	< 0.45	< 0.33	< 0.62	< 2	< 0.35
Dibenzo(a,h)anthracene	< 0.55	< 0.4	< 0.45	< 0.33	< 0.62	< 2	< 0.35
Fluoranthene	< 0.55	< 0.4	< 0.45	< 0.33	0.923	< 2	< 0.35
Fluorene	< 0.55	< 0.4	< 0.45	< 0.33	< 0.62	< 2	< 0.35
Indeno(1,2,3-cd)pyrene	< 0.55	< 0.4	< 0.45	< 0.33	< 0.62	< 2	< 0.35
Naphthalene	< 0.55	< 0.4	< 0.45	< 0.33	< 0.62	< 2	< 0.35
Phenanthrene	< 0.55	< 0.4	< 0.45	< 0.33	< 0.62	< 2	< 0.35
Pyrene	< 0.55	< 0.4	< 0.45	< 0.33	0.716	< 2	< 0.35
Total PAH	4.675	3.4	3.825	2.805	6.289	17	2.975

12/22/1993				
Analyte	SW-1	SW-2	SW-3	SW-4
1-Methyl naphthalene	1.4	< 0.59	< 1	< 5
2-Methylnaphthalene	< 0.37	< 0.15	< 0.26	< 1.3
Acenaphthene	< 0.57	< 0.24	< 0.4	< 2
Acenaphthylene	< 0.53	< 0.22	< 0.37	< 1.9
Anthracene	1.1	< 0.2	< 0.34	< 1.7
Benzo(a)anthracene	3.2	< 0.27	< 0.46	< 2.3
Benzo(a)pyrene	2	< 0.32	< 0.54	< 2.7
Benzo(b)fluoranthene				
Benzo(ghi)perylene	1.4	< 0.42	< 0.71	< 3.6
Benzo(k)fluoranthene	4.9	0.97	< 0.51	< 2.6
Chrysene	3.2	0.75	< 0.46	< 2.3
Dibenzo(a,h)anthracene	< 0.98	< 0.41	< 0.69	< 3.4
Fluoranthene	7.1	1.3	< 0.4	< 2
Fluorene	< 0.57	< 0.24	< 0.4	< 2
Indeno(1,2,3-cd)pyrene	1.6	< 0.41	< 0.69	< 3.4
Naphthalene	1	0.59	< 0.31	< 1.6
Phenanthrene	4.6	0.86	< 0.37	< 1.9
Pyrene	6	0.84	< 0.4	< 2
Total PAH	42.01	7.78	4.155	20.85

TABLE A-5
Grove Pond Sediment Pesticides and PCB's
Concentrations in ug/kg

Summary Stats

	Max concentration (ug/Kg)	Average concentration (ug/Kg)	Frequency of Detection
DDD	2500	321	41/41
DDE	980	122	45/88
DDT	3300	92	18/88
Endrin	28	11	2/73

	10/1/1992							12/22/1993							
	SED-A	SED-B	SED-C	SED-D	SED-E	SED-F	SED-G	S-1	S-2	S-3	S-4	SW-1	SW-2	SW-3	SW-4
4,4'-DDE	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<200	<100	<85	<71	<360
4,4'-DDT	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<200	<100	<85	<71	<360
Endrin	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<200	<100	<85	<71	<360
	4/29/1994							4/1/1995							
	SEDIMENT 1	SEDIMENT 2	SEDIMENT 3	SEDIMENT 4	SEDIMENT 5	SEDIMENT 6	SEDIMENT 7	GRD-95-08X	GRD-95-09X	GRD-95-10X	GRD-95-11X	GRD-95-12X	GRD-95-13X	GRD-95-14X	GRD-95-15X
4,4'-DDD	NA	30	130	130	40		10	100	70	150		130		740	380
4,4'-DDE	<10	10	20	20	<10	<10	<10	32	44	170	100	65	<7.6	280	250
4,4'-DDT	<10	<10	10	10	<10	<10	<10	59	<7.1	<7.1	<7.1	<7.1	<7.1	3300	<7.1
Endrin	<10	<10	<10	<10	<10	<10	<10	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.6	<6.5
	4/1/1995 (cont.)														
	GRD-95-16X	GRD-95-17X	GRD-95-18X	GRD-95-19X	GRD-95-20X	GRD-95-21X	GRD-95-22X	GRD-95-23X	GRD-95-24X	GRD-95-25X	GRD-95-26X	GRD-95-27X	GRD-95-28X	GRD-95-29X	GRD-95-30X
4,4'-DDD	430			88	1900				810	390	73	160	530	170	
4,4'-DDE	260	220	<7.6	97	930	<7.6	<7.6	<7.6	430	180	120	200	270	470	<7.6
4,4'-DDT	<7.1	<7.1	<7.1	<7.1	560	<7.1	<7.1	73	510	<7.1	<7.1	<7.1	<7.1	1500	<7.1
Endrin	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.6	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5
	4/1/1995 (cont.)														
	GRD-95-31X	GRD-95-32X	GRD-95-33X	GRD-95-34X	GRD-95-35X	GRD-95-36X	GRD-95-37X	GRD-95-38X	GRD-95-39X	GRD-95-40X	GRD-95-41X	GRD-95-42X	GRD-95-43X	GRD-95-44X	GRD-95-45X
4,4'-DDD	560	200			170	84			44		49				
4,4'-DDE	980	830	300	230	150	41	230	<7.6	230	<7.6	<7.6	<7.6	<7.6	<7.6	<7.6
4,4'-DDT	<7.1	<7.1	<7.1	<7.1	<7.1	<7.1	<7.1	<7.1	<7.1	<7.1	<7.1	<7.1	<7.1	<7.1	<7.1
Endrin	28	<6.6	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5
	4/1/1995 (cont.)														
	GRD-95-46X	GRD-95-47X	GRD-95-48X	GRD-95-49X	GRD-95-50X	GRD-95-51X	GRD-95-52X	GRD-95-53X	GRD-95-54X	GRD-95-55X					
4,4'-DDD	500	2500	100	230		200		240	520	260					
4,4'-DDE	190	570	40	180	200	<23	<7.6	220	<7.6	170					
4,4'-DDT	<7.1	<7.1	220	<7.1	<7.1	<7.1	<7.1	<7.1	<7.1	<7.1					
Endrin	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5	<6.5					
	4/1/1995														
	GRS-95-01X	GRS-95-02X	GRS-95-03X	GRS-95-04X	GRS-95-05X	GRS-95-06X	GRS-95-07X	GRS-95-08X	GRS-95-09X	GRS-95-10X	GRS-95-11X	GRS-95-12X	GRS-95-13X	GRS-95-14X	GRS-95-15X
4,4'-DDD		8.7	27			45	110				39				
4,4'-DDE	<7.6	12	100	<7.6	<7.6	10	160	<7.6	<7.6	<7.6	48	<7.6	50	<7.6	15
4,4'-DDT	18	30	160	<7.1	<7.1	100	450	<7.1	<7.1	<7.1	580	<7.1	260	<7.1	14
Endrin															

	2/2/2005		
	G-SED-1	G-SED-2	G-SED-3
4,4'-DDD	32		470
4,4'-DDE	76	96	310
4,4'-DDT	4.9	<2.1	<3.4
Endrin	4.9	<2.1	<3.4

TABLE A-6
Grove Pond Sediment VOCs

Summary Statistics

Analyte	Max (ug/kg)	Avg (ug/kg)	Frequency of Detection
Xylene (total)	16.4	4.01	1/22
Toluene	4.2	4.57	1/22

	10/1/1992	10/2/1992						12/22/1993							
	SED-B	SED-A	SED-C	SED-D	SED-E	SED-F	SED-G	S-1	S-2	S-3	S-4	SW-1	SW-2	SW-3	SW-4
Toluene	<5	<5	<5	<5	<5	<5	<5	<7.5	<7.5	<7.5	<30	<15	<13	<11	<54
Xylene (total)	<5	<5	<5	<5	<5	<5	<5	<5.0	<5.0	<5.0	<20	<10	<8.5	<7.1	<36
	4/29/1994														
	SEDIMENT 1	SEDIMENT 2	SEDIMENT 3	SEDIMENT 4	SEDIMENT 5	SEDIMENT 6	SEDIMENT 7								
Toluene	<2.0	<2.0	**4.20**	<2.0	<2.0	<2.0	<2								
Xylene (total)	**16.4**	<2.0	<2.0	<2.0	<2.0	<2.0	<2								

TABLE A-7
Grove Pond Fish Tissue Data
Whole body concentrations in mg/kg ww

Summary Stats

Chemical	Max concentration (mg/Kg)	Average concentration (mg/Kg)	Frequency of Detection
Aluminum	21	6.05	31/33
Antimony	ND	ND	0/5
Arsenic	0.13	0.20	2/33
Barium	3.68	1.27	33/33
Beryllium	0.99	0.07	8/33
Boron	1.39	0.20	15/28
Cadmium	1.02	0.12	23/22
Calcium	ND	ND	0/5
Chromium	1.80	0.67	33/33
Cobalt	ND	ND	0/5
Copper	1.35	0.60	33/33
Iron	77	33	33/33
Lead	5.02	0.72	27/33
Magnesium	745	488	33/33
Manganese	54	17	33/33
Mercury	1.14	0.21	30/33
Molybdenum	0.51	0.08	6/26
Nickel	4.85	0.39	15/33
Potassium	3400	503	5/5
Selenium	0.55	0.34	28/33
Silver	ND	ND	0/5
Sodium	1500	182	5/5
Strontium	48	19	28/28
Thallium	ND	ND	0/5
Vanadium	0.92	0.12	7/33
Zinc	42	18	33/33

June 30, 2004 Fish Data from EPA

	1992 Fish Data from Mierzykowski et al. (1993)													
Name	BBH1W	BBH2W	BBH3W	BBH6W	BG10W	BG1W	BG2W	BG3W	BG4W	BG5W	BG6W	BG7W	BG8W	BG9W
Aluminum	20.7	10.7	12.4	12.1	6.72	6.14	7.9	7.43	2.66	2.68	1.53	5.31	1.48	2.02
Antimony														
Arsenic	<0.103	<0.102	<0.104	<0.118	<0.12	<0.13	<0.144	<0.124	<0.126	<0.11	<0.124	<0.143	<0.132	<0.118
Barium	1.344	1.77	3.68	1.57	1.81	0.988	1.68	2.11	1.81	1.23	1.26	1.88	1.79	1.03
Beryllium	0.158	0.087	<0.021	<0.023	0.138	<0.026	<0.028	0.07	<0.025	<0.023	<0.025	<0.028	0.123	<0.023
Boron	0.536	0.244	<0.104	<0.116	0.419	<0.132	<0.141	0.462	0.155	0.163	0.127	<0.141	0.505	0.454
Cadmium	0.21	0.095	0.033	<0.023	0.162	0.079	0.051	0.132	0.057	0.05	0.058	0.113	0.234	0.083
Calcium														
Chromium	0.854	0.448	0.437	1.46	0.781	0.389	1.05	0.77	0.73	0.727	0.489	0.526	1.23	0.658
Cobalt														
Copper	0.943	0.564	0.57	1.35	0.731	0.769	0.544	0.599	0.788	0.37	0.529	0.52	0.69	0.457
Iron	76.56	68.35	75.71	61.51	27.01	34.77	41.45	56.94	29.52	28.66	8.75	24.61	25.82	28.73
Lead	1.27	0.6878	0.4227	0.2555	1.213	0.2271	0.2793	1.101	0.4544	0.218	0.3457	0.1632	1.384	0.8967
Magnesium	332.04	350.7	442.1	378.4	577.7	451.5	481.1	644.8	550.2	472.6	583.2	611.7	744.8	670.7
Manganese	7.744	8.419	8.63	14.44	22.77	20.86	11.2	48.39	24.32	18.04	13.89	26.87	31.99	25.87
Mercury	0.0349	<0.0204	<0.0207	0.0261	0.1662	0.0918	0.0849	0.1692	0.1493	0.1441	0.2351	0.2165	0.204	0.162
Molybdenum	<0.1092	<0.1086	<0.1044	<0.1155	0.1981	<0.1321	<0.1414	0.1479	<0.1256	<0.1159	<0.1258	<0.1419	0.1874	<0.1198
Nickel	0.9792	0.5071	0.1495	<0.1155	0.8011	0.1464	<0.1414	0.4497	0.1773	<0.1159	<0.1258	<0.1419	0.7859	<0.1198
Potassium														
Selenium	0.1429	0.2539	0.1981	0.2659	0.3159	0.2891	0.3757	0.3568	0.3579	0.2684	0.3362	0.3713	0.3787	0.2958
Silver														
Sodium														
Strontium	13.09	19.17	24.31	19.36	29.18	18.59	26.09	36.09	30.93	23.62	29.23	31.06	48.48	32.05
Thallium														
Vanadium	0.2256	0.1225	<0.1044	<0.1155	0.165	<0.1321	<0.1414	<0.1221	<0.1256	<0.1159	<0.1258	<0.1419	0.1655	<0.1198
Zinc	11.9	10.54	13.54	13.48	20.27	17.65	16.69	22.29	20.96	19.72	24.93	23.19	26.27	23.8

Name	LMB10W	LMB1W	LMB2W	LMB3W	LMB4W	LMB5W	LMB6W	LMB7W	LMB8W	LMB9W	YBH4W	YBH5W	YBH7W	YBH8W
Aluminum	7.97	10.19	7.29	7.51	5.41	4.98	3.66	11.8	6.01	3.81	3.57	2.47	6.44	6.41
Antimony														
Arsenic	<0.112	<0.195	<0.137	<0.134	<0.144	<0.132	<0.127	<0.131	<0.121	<0.122	<0.119	0.133	<0.102	0.129
Barium	1.12	0.22	0.202	0.238	0.366	0.174	0.277	1.04	0.173	1.06	0.619	0.778	1.78	0.594
Beryllium	<0.024	<0.027	<0.028	<0.026	<0.03	<0.025	<0.025	0.988	<0.025	0.105	<0.023	<0.022	0.085	<0.024
Boron	<0.117	<0.137	<0.138	0.139	0.214	<0.127	<0.126	1.39	<0.124	0.29	<0.117	<0.108	0.365	0.224
Cadmium	0.108	0.074	<0.028	0.03	0.031	<0.025	0.034	1.023	<0.025	0.128	<0.023	0.037	0.191	0.031
Calcium														
Chromium	0.545	0.494	0.533	0.545	0.613	0.385	0.454	1.34	0.413	0.594	0.506	0.321	0.38	0.337
Cobalt														
Copper	0.947	0.425	0.41	0.333	0.387	0.304	0.356	1.16	0.445	0.507	0.537	0.724	0.807	0.541
Iron	31.87	14.38	13.07	8.72	10.2	9.3	7.57	23.91	11.23	24.48	30.41	39.75	49.34	18.5
Lead	0.5657	0.1807	0.2556	0.2038	0.5059	0.1967	0.279	5.024	<0.1238	1.018	0.4267	0.2067	0.8589	0.265
Magnesium	477.2	423.5	396.1	485.9	517.5	403.6	556.8	489.4	439.5	512.3	461.9	329.6	370.3	394.1
Manganese	6.577	2.195	2.77	3.331	6.989	2.889	3.051	4.626	2.826	5.024	8.093	13.45	17.09	9.153
Mercury	0.3067	1.144	0.4991	0.3408	0.2328	0.2027	0.2793	0.068	0.2376	0.2605	0.0441	0.0709	0.0728	0.1283
Molybdenum	<0.1178	<0.1369	<0.1377	<0.1322	<0.1514	<0.1272	<0.1251	0.5074	<0.1238	0.1464	<0.1167	<0.108	0.1409	<0.1185
Nickel	<0.1176	<0.1369	<0.1377	0.1407	0.1808	<0.1272	0.245	4.847	<0.1238	0.6353	<0.1167	0.1092	0.5534	<0.1185
Potassium														
Selenium	0.3204	0.5538	0.3367	0.3422	0.3566	0.3281	0.3396	0.3573	0.3231	0.2356	0.4351	0.2278	0.2439	0.3776
Silver														
Sodium														
Strontium	24.8	17.19	12.28	13.9	22.38	14.53	15.79	14.31	11.68	29.22	29.72	13.5	17.45	24.09
Thallium														
Vanadium	<0.1178	<0.1369	<0.1377	<0.1322	<0.1514	<0.1272	<0.1261	0.9226	<0.1238	0.1371	<0.1157	<0.108	0.1471	<0.1185
Zinc	17.42	13.84	11.62	13.81	12.78	12.63	18.56	13.56	15.49	14.27	23.68	13.85	13.66	17.06

Name	Grove-East-BGSF-WB	Grove-East-BLCR-WB	Grove-West-BGSF-WB	Grove-West-BGSF-WB Dup	Grove-West-Pick-WB
Aluminum	<1.7	4.9	4	2	<1.5
Antimony	<0.86	<1.1	<1.1	<0.81	<0.76
Arsenic	<1.7	<2.2	<2.3	<1.6	<1.5
Barium	2.1	1.6	2.4	2.8	0.51
Beryllium	<0.086	<0.11	<0.12	<0.081	<0.076
Boron					
Cadmium	<0.26	<0.32	<0.34	<0.24	<0.23
Calcium	<1.7	<2.2	<2.3	<1.6	<1.5
Chromium	0.46	1.8	0.94	0.63	0.42
Cobalt	<0.26	<0.32	<0.34	<0.24	<0.23
Copper	0.44	0.34	0.76	0.52	0.36
Iron	34	28	51	70	12
Lead	<1.7	<2.2	<2.3	<1.6	<1.5
Magnesium	440	550	610	530	430
Manganese	49	36	50	54	17
Mercury	0.07	<0.21	0.23	0.2	0.62
Molybdenum					
Nickel	<0.52	<0.65	<0.69	<0.49	<0.45
Potassium	3300	3400	3400	3100	3400
Selenium	<0.86	<1.1	<1.1	<0.81	<0.76
Silver	<0.26	<0.32	<0.34	<0.24	<0.23
Sodium	1100	1200	1500	1300	920
Strontium					
Thallium	<1.7	<2.2	<2.3	<1.6	<1.5
Vanadium	<0.26	<0.32	<0.34	<0.24	<0.23
Zinc	19	21	25	23	42

TABLE A-8
Grove Pond Fish Tissue - Pesticides and PCBs Whole body concentrations in mg/kg wet weight

				Meirzykwsk 93 Fish Data_Organics.xls (collected 9/25/92)																												**Master-Joanne-only Fish2004.xls [Fish LIMs Data (2)] (collected 6/30/04)**				
Chemical	**max**	**average**	**FOD**	BBH1W	BBH2W	BBH3W	BBH6W	BG10W	BG1W	BG2W	BG3W	BG4W	BG5W	BG6W	BG7W	BG8W	BG9W	LMB10W	LMB1W	LMB2W	LMB3W	LMB4W	LMB5W	LMB6W	LMB7W	LMB8W	LMB9W	YBH4W	YBH5W	YBH7W	YBH8W	Grove-East-BGSF-WB	Grove-East-BLCR-WB	Grove-West-BGSF-WB	Grove-West-BGSF-WB Dup	Grove-West-Pick-WB
Aldrin	ND	ND	0/5																													<0.013	<0.012	<0.012	<0.011	<0.01
Alpha Chlordane	ND	ND	0/33	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.013	<0.012	<0.012	<0.011	<0.01
Alpha-BHC	ND	ND	0/33	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.013	<0.012	<0.012	<0.011	<0.01
Beta-BHC	ND	ND	0/33	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.013	<0.012	<0.012	<0.011	<0.01
cis-nonachlor	ND	ND	0/28	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					
Delta-BHC	ND	ND	0/5																													<0.013	<0.012	<0.012	<0.011	<0.01
Dieldrin	ND	ND	0/33	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.013	<0.012	<0.012	<0.011	<0.01
Endosulfan I	ND	ND	0/5																													<0.013	<0.012	<0.012	<0.011	<0.01
Endosulfan II	ND	ND	0/5																													<0.013	<0.012	<0.012	<0.011	<0.01
Endosulfan sulfate	ND	ND	0/5																													<0.013	<0.012	<0.012	<0.011	<0.01
Endrin	ND	ND	0/33	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.013	<0.012	<0.012	<0.011	<0.01
Endrin aldehyde	ND	ND	0/5																													<0.013	<0.012	<0.012	<0.011	<0.01
Endrin ketone	ND	ND	0/5																													<0.013	<0.012	<0.012	<0.011	<0.01
Gamma Chlordane	ND	ND	0/33	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.013	<0.012	<0.012	<0.011	<0.01
Gamma-BHC	ND	ND	0/33	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.013	<0.012	<0.012	<0.011	<0.01
Heptachlor	ND	ND	0/5																													<0.013	<0.012	<0.012	<0.011	<0.01
Heptachlor epoxide	ND	ND	0/33	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.013	<0.012	<0.012	<0.011	<0.01
Hexachlorobenzene	ND	ND	0/28	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					
Methoxychlor	ND	ND	0/5																													<0.013	<0.012	<0.012	<0.011	<0.01
Mirex	ND	ND	0/28	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					
omega?-BHC	ND	ND	0/28	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					
Oxychlordane	ND	ND	0/28	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					
o,p'-DDD	ND	ND	0/28	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					
o,p'-DDE	ND	ND	0/28	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					
o,p'-DDT	ND	ND	0/28	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					
4,4'-DDD	0.13	0.04	32/33	0.02	0.02	0.02	0.03	0.02	0.03	0.07	0.01	0.03	0.01	0.03	0.06	0.01	0.01	0.03	0.1	0.1	0.06	0.13	0.08	0.05	0.06	0.04	0.02	0.06	<0.01	0.03	0.02	0.026	0.033	0.029	0.013	0.023
4,4'-DDE	0.27	0.09	33/33	0.04	0.02	0.03	0.04	0.03	0.05	0.13	0.07	0.11	0.02	0.05	0.08	0.02	0.02	0.06	0.22	0.27	0.13	0.19	0.14	0.11	0.15	0.11	0.06	0.06	0.01	0.06	0.11	0.091	0.12	0.089	0.067	0.17
4,4'-DDT	ND	ND	0/33	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.013	<0.012	<0.012	<0.011	<0.01
Technical Chlordane	ND	ND	0/5																													<0.26	<0.24	<0.25	<0.22	<0.21
t-Nonachlor	ND	ND	0/28	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					
Toxaphene	ND	ND	0/33	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.26	<0.24	<0.25	<0.22	<0.21
Aroclor-1016	ND	ND	0/5																													<0.26	<0.24	<0.25	<0.22	<0.21
Aroclor-1221	ND	ND	0/5																													<0.26	<0.24	<0.25	<0.22	<0.21
Aroclor-1232	ND	ND	0/5																													<0.26	<0.24	<0.25	<0.22	<0.21
Aroclor-1242	ND	ND	0/5																													<0.26	<0.24	<0.25	<0.22	<0.21
Aroclor-1248	ND	ND	0/5																													<0.26	<0.24	<0.25	<0.22	<0.21
Aroclor-1254	ND	ND	0/5																													<0.26	<0.24	<0.25	<0.22	<0.21
Aroclor-1260	ND	ND	0/5																													<0.26	<0.24	<0.25	<0.22	<0.21
Aroclor-1262	ND	ND	0/5																													<0.26	<0.24	<0.25	<0.22	<0.21
Aroclor-1268	ND	ND	0/5																													<0.26	<0.24	<0.25	<0.22	<0.21
PCB (total)	0.47	0.13	14/28	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.09	0.14	<0.05	<0.05	0.15	0.38	0.47	0.22	0.42	0.24	0.19	0.42	0.2	0.11	<0.05	<0.05	0.13	0.09					

TABLE A-9
Groce Pond Fish Tissue Data Summary Stats for Each Fish Species Collected Concentrations in mg/kg ww

	Brown Bulhead			Bluegill			Largemouth Bass			Yellow Bullhead			Black crappie	Pickerel
	Max concentration (mg/Kg)	Average concentration (mg/Kg)	Frequency of Detection	Max concentration (mg/Kg)	Average concentration (mg/Kg)	Frequency of Detection	Max concentration (mg/Kg)	Average concentration (mg/Kg)	Frequency of Detection	Max concentration (mg/Kg)	Average concentration (mg/Kg)	Frequency of Detection	Concentration (mg/kg, n=1)	Concentration (mg/kg, n=1)
Inorganics														
Aluminum	20.7	13.98	4/4	7.9	4.06	11/12	11.8	6.86	10/10	6.44	4.72	4/4	4.9	<1.5
Antimony	NA	NA	NA	ND	ND	0/2	NA	NA	NA	NA	NA	NA	<1.1	<0.76
Arsenic	ND	ND	0/4	ND	ND	0/12	ND	ND	ND	0.13	0.09	2/4	<2.2	<1.5
Barium	3.68	2.09	4/4	2.4	1.67	12/12	1.12	0.49	10/10	1.78	0.94	4/4	1.6	0.51
Beryllium	0.158	0.07	2/4	0.138	0.04	3/12	0.988	0.12	2/10	0.09	0.03	1/4	<0.11	<0.076
Boron	0.536	0.22	2/4	0.505	0.25	7/10	1.39	0.24	4/10	0.37	0.18	2/4	NA	NA
Cadmium	0.21	0.09	3/4	0.234	0.11	10/12	1.023	0.15	7/10	0.19	0.07	3/4	<0.32	<0.23
Calcium	NA	NA	NA	ND	ND	0/2	NA	NA	NA	NA	NA	NA	<2.2	<1.5
Chromium	1.46	0.80	4/4	1.23	0.73	12/12	1.34	0.59	10/10	0.51	0.39	4/4	1.8	0.42
Cobalt	NA	NA	NA	ND	ND	0/2	NA	NA	NA	NA	NA	NA	<0.32	<0.23
Copper	1.35	0.86	4/4	0.788	0.60	12/12	1.16	0.53	10/10	0.81	0.65	4/4	0.34	0.36
Iron	76.56	70.53	4/4	56.94	32.61	12/12	31.87	15.47	10/10	49.34	34.50	4/4	28	12
Lead	1.27	0.66	4/4	1.384	0.69	10/12	5.024	0.83	9/10	0.86	0.44	4/4	<2.2	<1.5
Magnesium	442.1	375.81	4/4	744.8	569.86	12/12	556.8	470.18	10/10	461.90	388.98	4/4	550	430
Manganese	14.44	9.81	4/4	50	28.60	12/12	6.989	4.03	10/10	17.09	11.95	4/4	36	17
Mercury	0.0349	0.02	2/4	0.2351	0.16	12/12	1.144	0.36	10/10	0.13	0.08	4/4	<0.21	0.62
Molybdenum	ND	ND	0/4	0.1981	0.10	3/10	0.5074	0.12	2/10	0.14	0.08	1/4	NA	NA
Nickel	0.9792	0.42	3/4	0.8011	0.27	5/12	4.847	0.64	5/10	0.55	0.20	2/4	<0.65	<0.45
Potassium	NA	NA	NA	3400	3350.00	2/2	NA	NA	NA	NA	NA	NA	3400	3400
Selenium	0.2659	0.22	4/4	0.3787	0.36	10/12	0.5538	0.35	10/10	0.44	0.32	4/4	<1.1	<0.76
Silver	NA	NA	NA	ND	ND	0/2	NA	NA	NA	NA	NA	NA	<0.32	<0.23
Sodium	NA	NA	NA	1500	1300.00	2/2	NA	NA	NA	NA	NA	NA	1200	920
Strontium	24.31	18.98	4/4	48.48	30.53	10/10	29.22	17.61	10/10	29.72	21.19	4/4	NA	NA
Thallium	NA	NA	NA	ND	ND	0/2	NA	NA	NA	NA	NA	NA	<2.2	<1.5
Vanadium	0.2256	0.11	2/4	0.1655	0.10	2/12	0.9226	0.16	2/10	0.15	0.08	1/4	<0.32	<0.23
Zinc	13.54	12.37	4/4	26.27	21.65	12/12	18.56	14.40	10/10	23.68	17.06	4/4	21	42
Organics			NA			0/0								
Aldrin	NA	NA	NA	ND	ND	0/2	NA	NA	NA	NA	NA	NA	<0.012	<0.01
Alpha Chlordane	ND	ND	0/4	ND	ND	0/12	ND	ND	ND	ND	ND	ND	<0.012	<0.01
Alpha-BHC	ND	ND	0/4	ND	ND	0/12	ND	ND	ND	ND	ND	ND	<0.012	<0.01
Beta-BHC	ND	ND	0/4	ND	ND	0/12	ND	ND	ND	ND	ND	ND	<0.012	<0.01
cis-nonachlor	ND	ND	0/4	ND	ND	0/10	ND	ND	ND	ND	ND	ND	NA	NA
Delta-BHC	NA	NA	NA	ND	ND	0/2	NA	NA	NA	NA	NA	NA	<0.012	<0.01
Dieldrin	ND	ND	0/4	ND	ND	0/12	ND	ND	ND	ND	ND	ND	<0.012	<0.01
Endosulfan I	NA	NA	NA	ND	ND	0/2	NA	NA	NA	NA	NA	NA	<0.012	<0.01
Endosulfan II	NA	NA	NA	ND	ND	0/2	NA	NA	NA	NA	NA	NA	<0.012	<0.01
Endosulfan sulfate	NA	NA	NA	ND	ND	0/2	NA	NA	NA	NA	NA	NA	<0.012	<0.01
Endrin	ND	ND	0/4	ND	ND	0/12	ND	ND	ND	ND	ND	ND	<0.012	<0.01
Endrin aldehyde	NA	NA	NA	ND	ND	0/2	NA	NA	NA	NA	NA	NA	<0.012	<0.01
Endrin ketone	NA	NA	NA	ND	ND	0/2	NA	NA	NA	NA	NA	NA	<0.012	<0.01
Gamma Chlordane	ND	ND	0/4	ND	ND	0/12	ND	ND	ND	ND	ND	ND	<0.012	<0.01
Gamma-BHC	ND	ND	0/4	ND	ND	0/12	ND	ND	ND	ND	ND	ND	<0.012	<0.01
Heptachlor	NA	NA	NA	ND	ND	0/2	NA	NA	NA	NA	NA	NA	<0.012	<0.01
Heptachlor epoxide	ND	ND	0/4	ND	ND	0/12	ND	ND	ND	ND	ND	ND	<0.012	<0.01
Hexachlorobenzene	ND	ND	0/4	ND	ND	0/10	ND	ND	ND	ND	ND	ND	NA	NA
Methoxychlor	NA	NA	NA	ND	ND	0/2	NA	NA	NA	NA	NA	NA	<0.012	<0.01
Mirex	ND	ND	0/4	ND	ND	0/10	ND	ND	ND	ND	ND	ND	NA	NA
omega?-BHC	ND	ND	0/4	ND	ND	0/10	ND	ND	ND	ND	ND	ND	NA	NA
Oxychlordane	ND	ND	0/4	ND	ND	0/10	ND	ND	ND	ND	ND	ND	NA	NA
o,p'-DDD	ND	ND	0/4	ND	ND	0/10	ND	ND	ND	ND	ND	ND	NA	NA
o,p'-DDE	ND	ND	0/4	ND	ND	0/10	ND	ND	ND	ND	ND	ND	NA	NA
o,p'-DDT	ND	ND	0/4	ND	ND	0/10	ND	ND	ND	ND	ND	ND	NA	NA
4,4'-DDD	0.03	0.02	4/4	0.07	0.03	12/12	0.13	0.07	10/10	0.06	0.03	3/4	0.033	0.023
4,4'-DDE	0.04	0.03	4/4	0.13	0.06	12/12	0.27	0.14	10/10	0.11	0.06	4/4	0.12	0.17
4,4'-DDT	ND	ND	0/4	ND	ND	0/12	ND	0.01	ND	ND	ND	ND	<0.012	<0.01
Technical Chlordane	NA	NA	NA	ND	ND	0/2	0	NA	NA	NA	NA	NA	<0.24	<0.21
t-Nonachlor	ND	ND	0/4	ND	ND	0/10	ND	ND	ND	ND	ND	ND	NA	NA
Toxaphene	ND	ND	0/4	ND	ND	0/12	ND	ND	ND	ND	ND	ND	<0.24	<0.21
Aroclor-1016	NA	NA	NA	ND	ND	0/2	NA	NA	NA	NA	NA	NA	<0.24	<0.21
Aroclor-1221	NA	NA	NA	ND	ND	0/2	NA	NA	NA	NA	NA	NA	<0.24	<0.21
Aroclor-1232	NA	NA	NA	ND	ND	0/2	NA	NA	NA	NA	NA	NA	<0.24	<0.21
Aroclor-1242	NA	NA	NA	ND	ND	0/2	NA	NA	NA	NA	NA	NA	<0.24	<0.21
Aroclor-1248	NA	NA	NA	ND	ND	0/2	NA	NA	NA	NA	NA	NA	<0.24	<0.21
Aroclor-1254	NA	NA	NA	ND	ND	0/2	NA	NA	NA	NA	NA	NA	<0.24	<0.21
Aroclor-1260	NA	NA	NA	ND	ND	0/2	NA	NA	NA	NA	NA	NA	<0.24	<0.21
Aroclor-1262	NA	NA	NA	ND	ND	0/2	NA	NA	NA	NA	NA	NA	<0.24	<0.21
Aroclor-1268	NA	NA	NA	ND	ND	0/2	NA	NA	NA	NA	NA	NA	<0.24	<0.21
PCB (total)	ND	ND	0/4	0.14	0.04	2/10	0.47	0.28	10/10	0.13	0.07	2/4	NA	NA

TABLE A-10
Grove Pond Invertebrate Data
Concentrations in mg/kg ww

			Mierzykowski and Carr (September 2000)			**Haines and Longcore (2001)**															
			1998 Crayfish (ug/g ww)			Benthic Invertebrates (ug/g ww)															
						Cambarida								Corduliidae							
			Grove Pd (below Barnum Gt Br)			Army Wells		Ayer Wells		Inlet		Tannery		Army Wells		Ayer Wells		Inlet		Tannery	
Chemical	**Max (mg/kg ww)**	**Average (mg/kg ww)**	BAR-CY01	BAR-CY02	BAR-CY03	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range
Aluminum	30	26.7	30	20.6	29.6																
Arsenic	1.72	0.86	1.18	1.33	1.72	0.76	0.63-0.88	0.69	-	0.08	-	-	-	0.83	0.61-1.17	0.53	0.52-0.54	0.86	0.72-1.01	0.6	0.48-0.71
Barium	37.5	30.5	37.5	25.6	28.5																
Boron	ND	ND	nd	nd	nd																
Cadmium	1.07	0.24	1.07	0.31	0.29	0.12	0.05-0.14	0.15	-	0.03	-	-	-	0.14	0.05-0.23	0.14	0.1-0.17	0.13	0.09-0.18	0.06	0.05-0.06
Chromium	3.54	1.25	1.19	0.8	0.56	2.13	0.97-3.54	1.96	-	0.33	-	-	-	1.3	0.48-2.37	1.22	0.81-1.63	0.92	0.51-1.34	2.05	1.94-2.15
Copper	25.4	19.0	25.4	16	15.5																
Iron	332	260.0	224	224	332																
Lead	0.89	0.35	0.89	0.45	0.67	0.35	0-0.76	0.44	-	0.05	-	-	-	0.21	0-.048	0.19	.16-.23	0.18	.11-.26	0.07	0-.15
Magnesium	404	396.0	402	382	404																
Manganese	785	719.3	726	647	785																
Total Mercury	0.051	0.0319	0.0244	0.0218	0.0349	0.043	0.038-0.049	0.029	-	0.031	-	-	-	0.032	.016-.041	0.044	.037-.051	0.029	.026-.032	0.03	.028-.031
Methyl Mercury	0.046	0.0256	0.0255	0.0266	0.0257	0.033	0.013-0.046	0.021	-	0.038	-	-	-	0.029	.017-.040	0.021	.019-.023	0.019	.018-.020	0.017	.010-.024
%Mehg			105%	122%	74%	77%		72%		123%				91%		48%		66%		57%	
Nickel	2.14	1.26	2.14	0.88	0.76																
Selenium	ND	ND	nd	nd	nd																
Strontium	156	140.3	120	145	156																
Zinc	34.7	28.4	34.7	25.5	25																

Sample sizes were not reported in Haines and Longcore (2001). Therefore, in cases where ranges are also not reported, there is no way to determine a maximum concentration at the location. The average concentrations are treated as composite samples in these circumstances and are considered maximum values.

TABLE A-11
Grove Pond Invertebrate Data Summary Stats by Tazonomic Group

Chemical	Crayfish Max (mg/kg ww)	Crayfish Average (mg/kg ww)[a]	Crayfish Sample Size[b]	Odonata Max (mg/kg ww)	Odonata Average (mg/kg ww)[a]	Odonata Sample Size[c]
Aluminum	30	27	3	NA	NA	NA
Arsenic	1.7	0.96	6	1.17	0.71	4
Barium	38	31	3	NA	NA	NA
Boron	ND	ND	3	NA	NA	NA
Cadmium	1.1	0.33	6	0.23	0.12	4
Chromium	3.5	1.2	6	2.37	1.37	4
Copper	25	19	3	NA	NA	NA
Iron	332	260	3	NA	NA	NA
Lead	0.89	0.48	6	0.26	0.16	4
Magnesium	404	396	3	NA	NA	NA
Manganese	785	719	3	NA	NA	NA
Total Mercury	0.049	0.031	6	0.05	0.03	4
Methyl Mercury	0.046	0.028	6	0.04	0.02	4
Nickel	2.1	1.3	3	NA	NA	NA
Selenium	ND	ND	3	NA	NA	NA
Strontium	156	140	3	NA	NA	NA
Zinc	35	28	3	NA	NA	NA

The information in this table was derived from the data presented in the previous table entitled Grove Pond Invertebrate Data.

a. Average concentrations were not calculated using 1/2 the detection limit, as was done for other media, because detection limits were not available. Average concentrations were calculated using detected values only.

b. The frequency of detection (FOD) could not be determined for crayfish because sample sizes from Haines and Longcore (2001) are not available. Sample sizes of 3 are direct counts from the 1998 crayfish data. Sample sizes of 6 are based on the 3 samples from 1998 plus the 3 composite samples in Haines and Longcore (2001).

c. The frequency of detection (FOD) could not be determined for odonata because sample sizes from Haines and Longcore (2001) are not available. Sample sizes of 4 are based on the number of composite samples presented in Haines and Longcore (2001).

TABLE A-12
Grove Pond Frog Tissue Data
Concentrations in mg/kg ww

			Date	27-Jul-99	27-Jul-99	27-Jul-99	27-Jul-99	27-Jul-99	28-Jul-99	28-Jul-99	28-Jul-99	29-Jul-99	29-Jul-99	29-Jul-99	02-Aug-99	02-Aug-99	02-Aug-99	02-Aug-99	03-Aug-99	03-Aug-99	03-Aug-99	03-Aug-99	04-Aug-99	05-Aug-99	05-Aug-99	05-Aug-99	05-Aug-99	05-Aug-99
			Location	East	East	East	West	East	West	East	West	East	East	East	West	West	West	East	West	East	East	West	East	East	West	West	West	West
Inorganics (ug/g ww)	Max	Average	Sample #	GPF01	GPF02	GPF03	GPF04	GPF05	GPF06	GPF07	GPF08	GPF09	GPF10	GPF11	GPF12	GPF13	GPF14	GPF15	GPF16	GPF17	GPF18	GPF19	GPF20	GPF21	GPF22	GPF23	GPF24	GPF25
aluminum	108	22		4.68	7.17	2	11.2	11.3	20	16.6	7.36	10.3	4.96	17.2	2.28	86.8	18.7	23.5	108	41.4	9.24	22.6	15.8	10.1	42.5	3.94	37.4	14.8
arsenic	0.478	0		0.102	0.101	0.101	0.0943	0.101	0.171	0.221	0.167	0.0582	0.081	0.124	0.0349	0.478	0.206	0.113	0.291	0.122	0.0624	0.266	0.0392	0.0883	0.278	0.0649	0.122	0.0924
barium	13.7	5		3.51	3.95	3.47	3.37	4.33	1.99U	2.61U	1.92U	2.13U	3.09	4.88	1.8U	13.7	12	8.04	7.51	5.84	2.02	9.94	4.16	3.22	7.69	8.31	3.21U	3.65
beryllium	nd	ND		0.1U	.1U	.1U	.1U	.1U	.1U	.1U	.1U	.1U	.1U	.1U	.1U	.1U	.1U	.1U	.1U	.1U	.1U	.1U	.1U	.1U	.1U	.1U	.1U	.1U
boron	nd	ND		2U	2U	2U	2U	.53U	2U	2U	2U	2U	2U	2U	2U	2U	.716U	2U	2U	.727U	.609U	2U	2U	2U	2U	2U	2U	2U
cadmium	0.269	0		0.1U	.1U	.1U	.1U	.1U	.1U	.1U	.1U	.1U	.1U	0.0533	.1U	0.269	0.219	0.0548	0.0665	0.0499	.1U	0.0662	.1U	0.155	0.0727	.1U	0.052	0.0504
chromium	11.4	1		0.5U	.5U	.5U	1.14	0.24	0.686	0.343	0.37	0.226	.5U	1.08	1.37	4.2	0.643	0.996	11.4	0.998	0.244	1.19	0.261	0.544	1.39	0.267	0.453	0.559
copper	59.2	6		1.92U	1.28U	1.86U	1.93U	.837U	2.09U	2.2U	31.2	0.89	4.4	1.7U	59.2	3.79	3.4U	3.6	6.02	8.44	1.22U	3.55	1.55U	1.76U	9.07	1.4	2.3U	3.66
iron	280	70		34.6	39.6	20.4U	45.3	32.5	63.1	43.7	91.9	40.2	27.1	60.4	29.3	188	53.9	101	280	82.6	28.9	82.4	37.7	40.9	160	45.7	73.4	45.5
lead	2.69	1		0.243U	.142U	.5U	0.277U	.106U	.274U	.341U	1.51	.27U	.213U	.292U	2.06	0.768	.516U	0.678	0.847	2.69	.213U	0.253U	.212U	.352U	1.24	0.517	.284U	.259U
magnesium	438	290		271	295	275	375	315	231	271	270	268	235	273	258	251	242	278	397	438	295	274	361	295	362	253	230	235
manganese	70.3	23		23.4	33.1	32.5	12.5	33.8	10.6	7.56	13.6	6.83	20.4	44.4	6.72	38.9	27.3	9.55	70.3	30.9	6.55	29	18	5.01	59.9	5.7	15	13.9
total mercury	0.239	0		0.0527	0.0882	0.0639	0.109	0.0782	0.117	0.0419	0.0546	0.0429	0.0304	0.0277	0.108	0.0557	0.0605	0.0186	0.136	0.0536	0.0612	0.085	0.0364	0.0444	0.239	0.0138	0.0961	0.0862
MeHg	0.243	0		0.0563	0.117	0.0697	0.139	0.0972	0.154	0.0495	0.0578	0.0539	0.0409	0.0326	0.131	0.0592	0.0441	0.00436	0.243	0.0522	0.0429	0.0562	0.0189	0.0608	0.222	0.00654	0.108	0.0928
molybdenum	nd	ND		2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U
nickel	21.9	2		.5U	.5U	.5U	0.613	.5U	0.422	.5U	2.7	.5U	.5U	.5U	11	0.416	.5U	.5U	15.5	21.9	.5U	0.209	.5U	.5U	0.486	.5U	.5U	1.71
selenium	0.644	0		0.168	0.5	0.194	0.157	0.129	0.206	0.326	0.253	0.147	0.161	0.148	0.194	0.637	0.644	0.174	0.177	0.291	0.359	0.142	0.154	0.147	0.244	0.182	0.237	0.242
strontium	30.7	14		13.4	14.9	12.4	15.1	17.8	9.69	18.2	11	10.2	8.33	11.9	13	10.8	8.09	12.4	26.4	30	13.7	10.4	16	7.99	30.7	7.79	8.02	7.62
vanadium	0.308	0		0.5U	.5U	.5U	.5U	.5U	.5U	.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.201	0.5U	0.5U	0.308	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
zinc	73.4	23		14.3	16.7	14.6	19.6	17.7	13.4	18.2	30.7	14.6	13.9	15.5	39.3	73.4	58	17.1	22	28.7	14.7	16.9	19.8	19.1	23.5	20.1	14.1	17.1

Source:
EPA 2001

TABLE A-13
Grove Pond Tree Swallow Egg Data
Concentrations in mg.kg ww

Chemical	Max	Average	Grove Pond Eggs 1998 (mg/kg) Mean	n (det)	n (ND)	range	1/2 Max DL	Grove Pond Eggs 1999 (mg/kg) Mean	n (det)	n (ND)	range	1/2 Max DL
Mercury	1.075	0.574	0.836	6	0	0.353-1.020		0.462	14	0	0.231-1.075	
Arsenic	0.95	0.248	0.68	3	3	0.45-0.95	0.2	BD	0	14	BD	0.165
Cadmium	0.53	0.079	0.53	1	5	na	0.2	BD	0	14	BD	0.0037
Chromium	0.61	0.215	0.46	3	3	0.38-0.61	0.2	BD	0	14	BD	0.165
Lead	0.47	0.216	0.47	1	5	na	0.2	0.325	4	10	0.2-0.4	0.155

NA indicates no samples analyzed
BD indicates delow detection

Haines, T.A. and J.R. Longcore. 2001. Final Report, Bioavailability and Potential Effects of Mercury and Selected Other Trace Metals on Biota in Plow Shop and Grove Ponds, Fort Devens, Massachusetts. USGS Report to the EPA. April 2001.

TABLE A-14
Grove Pond Tree Swallow Stomach Content Data
Concentrations in mg.kb ww

Chemical	Max	Average	Grove Pond Food Boli 1998 (mg/kg)				Grove Pond Food Boli 1999 (mg/kg)				
			Mean	n	range	% < LOD (range)	Mean	n	n(ND)	range	1/2 max DL
Mercury	0.272	0.1982	NA	NA	NA	NA	0.1982	10	0	0.140-0.272	-
Arsenic	6.81	1.192	NA	NA	NA	NA	4.2	2	8	1.55-6.81	0.44
Cadmium	1.39	0.78	NA	NA	NA	NA	0.78	10	0	0.32-1.39	-
Chromium	1113	197	NA	NA	NA	NA	197	10	0	7.7-1113	-
Lead	5.38	2.46	NA	NA	NA	NA	2.46	10	0	0.69-5.38	-

NA indicates no samples analyzed

Haines, T.A. and J.R. Longcore. 2001. Final Report, Bioavailability and Potential Effects of Mercury and Selected Other Trace Metals on Biota in Plow Shop and Grove Ponds, Fort Devens, Massachusetts. USGS Report to the EPA. April 2001.

Appendix B
Data Summary Table for Plow Shop Pond

TABLE B-1
Plow Shop Pond Surface Water Inorganics - Dissolved
Concentrations in ug/l

				11/3/2004						11/19/2004			
Dissolved Metals	Max (ug/L)	Avg (ug/L)	Frequency of Detection	PS1-2004	PS2-2004	PS3-2004	PS4-2004	PS5-2004	PS6-2004	RCSW1	RCSW2	RCSW3	RCSW4
Aluminum	ND	ND	0/10	<5	<5	<5	<5	<5	<5	<5	<5	<5	<20
Antimony	ND	ND	0/10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
Arsenic	9.7	2.161	10/10	1.2	1	0.76	0.82	0.76	0.77	1.4	1.9	9.7	3.3
Barium	26	12.6	10/10	10	9.2	9.5	9.3	11	11	10	11	19	26
Beryllium	ND	ND	0/10	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.81
Cadmium	ND	ND	0/10	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.81
Calcium	11000	6205.3	10/10	11000	11000	10000	10000	10000	10000	12	13	14	14
Chromium	ND	ND	0/10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
Cobalt	13	4.07	10/10	0.32	3.3	0.86	0.33	0.29	0.3	13	1	9.3	12
Copper	3.2	1.181	10/10	1.1	1.1	0.86	0.82	1.1	1.1	3.2	0.99	0.64	0.9
Iron	2900	464.3	10/10	110	97	87	89	120	120	230	210	2900	680
Lead	0.23	0.1435	1/10	<0.2	<0.2	<0.2	<0.2	0.23	<0.2	<0.2	<0.2	<0.2	<0.81
Magnesium	2200	1270.98	10/10	2200	2200	2000	2100	2100	2100	2	2	3	2.8
Manganese	390	125.1	10/10	28	16	15	20	78	74	90	180	360	390
Mercury	ND	ND	0/6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA	NA	NA	NA
Nickel	2.9	1.379	10/10	0.98	0.94	0.84	0.71	0.76	0.76	2.9	1.1	2.1	2.7
Potassium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	ND	ND	0/10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<4
Silver	ND	ND	0/10	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.81
Sodium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	ND	ND	0/10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
Vanadium	ND	ND	0/10	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.81
Zinc	11	5.08	3/10	<5	<5	5.3	<5	<5	<5	11	9.5	<5	<20

TABLE B-2
Plow Shop Pond Surface Water Inorganics - Total
Concentration in ug/L

Total metals	Max (ug/L) All	Max (ug/L) 2004 only	Avg (ug/L) All	Avg (ug/L) 2004 only	Frequency of Detection All	Frequency of Detection 2004 only
Aluminum	225	35	27.1	13	13 of 26	7 of 11
Antimony	5.00	ND	2.1	ND	6 of 12	ND
Arsenic	380	380	17.5	37	24 of 47	5 of 11
Barium	44	44	10.9	15	30 of 59	11 of 11
Beryllium	1.00	ND	0.5	ND	6 of 12	ND
Cadmium	1.50	ND	0.7	ND	6 of 12	ND
Calcium	18600	12000	9390.0	5734	30 of 59	11 of 11
Chromium	3.00	1	1.9	0.96	13 of 26	7 of 11
Cobalt	1.50	0.83	0.7	0.25	7 of 14	1 of 11
Copper	49	6	7.7	2.83	28 of 55	11 of 11
Iron	29000	29000	1420.2	3154	30 of 59	11 of 11
Lead	5.00	0.4	2.0	0.32	12 of 24	6 of 11
Magnesium	3300	2300	1693.9	1119	30 of 59	11 of 11
Manganese	590	530	117.8	150	30 of 59	11 of 11
Mercury	ND	ND	ND	ND	ND	ND
Nickel	44	2.9	8.2	1.26	24 of 47	11 of 11
Potassium	3000	ND	834.9	ND	24 of 47	ND
Selenium	20	1	7.8	1.09	7 of 14	1 of 11
Silver	3.60	ND	0.9	ND	8 of 16	ND
Sodium	25100	ND	15902.1	ND	24 of 47	ND
Thallium	20	ND	7.4	ND	6 of 12	ND
Vanadium	1.50	ND	0.8	ND	6 of 12	ND
Zinc	58	10	13.3	6.25	20 of 39	8 of 11

	1/1/1991												
	SW-SHL-01	SW-SHL-02	SW-SHL-03	SW-SHL-04	SW-SHL-05	SW-SHL-06	SW-SHL-07	SW-SHL-08	SW-SHL-09	SW-SHL-10	SW-SHL-11	SW-SHL-12	SW-SHL-13
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	4.51	3.22	4.04	4.16	4.97	6.26	3.57	2.99	6.84	3.64	3.11	3.46	2.99
Barium	5.53	5.38	3.35	4.32	5.91	6.14	5.77	4.09	5.25	4.39	7.23	11.8	8.48
Beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	12000	12000	12000	12000	12000	12000	11000	12000	12000	13000	12000	9500	12000
Chromium	<4.47	<4.47	<4.47	<4.47	<4.47	<4.47	<4.47	<4.47	<4.47	<4.47	<4.47	<4.47	<4.47
Cobalt	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	14.4	26.3	11.2	48.7	6.02	<4.29	33.1	14.6	5.17	<4.29	4.86	8.33	9.27
Iron	232	241	214	365	530	460	323	538	538	248	288	500	423
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	1900	1900	2000	1900	2300	2300	2000	2000	2300	2000	2300	2000	2100
Manganese	41.6	16.4	11.8	12.8	29.6	13.6	15.4	7.81	53.9	49.7	45.6	139	20.3
Mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	15.7	27.5	13	44.2	<8.76	<8.76	41	17.9	<8.76	<8.76	<8.76	10.2	<8.76
Potassium	852	778	741	785	933	1100	852	830	1100	1000	911	911	1040
Selenium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	<0.316	<0.316	<0.316	<0.316	<0.316	0.564	<0.316	<0.316	3.6	<0.316	<0.316	<0.316	<0.316
Sodium	20000	20000	21000	21000	21000	22000	23000	22000	21000	23000	25000	23000	21000
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	21.5	32.2	<19.4	58.1	19.4	<19.4	39	<19.4	<19.4	<19.4	19.4	<19.4	<19.4

	9/11/1998		9/11/1998				11/19/2004				7/16/2004	11/3/2004					
	NON-1	NON-2	PSEM-1	PSEM-2	PSEM-3	PSEM-4	RCSW1	RCSW2	RCSW3	RCSW4	RED COVE	PS1-2004	PS2-2004	PS3-2004	PS4-2004	PS5-2004	PS6-2004
Aluminum	225	51.1	10	10	10	10	<20	<20	<20	<20	35	12	10	8	16	12	11
Antimony	5	5	5	5	5	5	<2	<2	<2	<2	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Arsenic	10	10	10	10	10	20	<4	<4	5.9	7	380	2	1.4	<1	<1	<1	<1
Barium	14.9	19.9	13.5	9.4	8.2	15.3	9.7	12	15	27	44	11	9.2	9.7	9.4	11	11
Beryllium	1	1	1	1	1	1	<0.8	<0.8	<0.8	<0.8	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cadmium	1.5	1.5	1.5	1.5	1.5	1.5	<0.8	<0.8	<0.8	<0.8	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Calcium	13.3	15.7	16200	15400	14900	18600	12	12	13	14	21	12000	11000	10000	10000	10000	10000
Chromium	3	3	3	3	3	3	<2	<2	<2	<2	1	0.9	0.8	0.9	1	1	1
Cobalt	1.5	1.5	1.5	1.5	1.5	1.5	<0.8	<0.8	<0.8	0.83	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Copper	1.5	1.5	5	1.5	1.5	1.5	4	2.9	2.2	4	2	2	2	1	3	6	2
Iron	2.2	3.2	720	460	230	1600	320	690	1100	1900	29000	420	280	220	220	260	280
Lead	5	5	5	5	5	5	<0.8	<0.8	<0.8	<0.8	0.24	0.3	0.2	<0.2	0.4	0.3	0.4
Magnesium	2.3	2.8	3100	2600	2500	3300	2.2	2.2	2.3	2.5	3.4	2300	2100	2000	1900	2000	2000
Manganese	531	590	16.8	193	9.8	81.7	51	140	210	440	530	34	16	27	29	91	87
Mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel	6	6	6	6	6	6	1.1	1.2	1.2	1.6	2.9	1	0.91	0.8	1.4	0.85	0.94
Potassium	1.6	1.8	2100	1700	1400	3000	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Selenium	20	20	20	20	20	20	<4	<4	<4	<4	<1	1	<1	<1	<1	<1	<1
Silver	3	3	3	3	3	3	<0.8	<0.8	<0.8	<0.8	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sodium	25.1	26	25000	25100	23500	25000	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Thallium	20	20	20	20	20	20	<2	<2	<2	<2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Vanadium	1.5	1.5	1.5	1.5	1.5	1.5	<0.8	<0.8	<0.8	<4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Zinc	12	12	12	12	12	12	<8	<8	10	<20	3.7	3	9	4	6	8	7

TABLE B-3
Plow Shop Pond Sediment Metals Concentration in mg/kg dw

Summary Statistics

Chemical	Max (mg/kg)	Average (mg/kg)	Frequency of Detection
Aluminum	27000	8228	119/119
Antimony	30.7	16	5/63
Arsenic	6800	542	133/135
Barium	370	101	117/123
Beryllium	2.72	1.42	26/99
Cadmium	66	10	65/125
Calcium	34000	8061	117/119
Chromium	37800	2275	126/136
Cobalt	59	12	66/107
Copper	3450	123	102/122
Iron	410000	55485	119/119
Lead	1214.31	169	121/135
Magnesium	8580	1757	114/119
Manganese	54800	2348	117/121
Mercury	250	27	123/133
Methyl mercury	0.08189	0.04	10/10
Nickel	87.8	30	92/122
Potassium	2340	953	50/119
Selenium	14.7	14	30/110
Silver	2	4.87	6/61
Sodium	5280	1687	82/118
Thallium	29.4	47.2 a	3/48
Vanadium	166	27	69/120
Zinc	1100	199	93/122

a. The average concentration for thallium is higher than the maximum concentration because of the elevated detection limits. The average of the 10 detected values is 23.3 mg/kg, which is the value used in the food chain modeling.

	1/1/1991												
	SESHL01	SESHL02	SESHL03	SESHL04	SESHL05	SESHL06	SESHL07	SESHL08	SESHL09	SESHL10	SESHL11	SESHL12	SESHL13
Aluminum	14000	17000	1600	2200	14000	2700	963	23000	20000	19000	22000	9900	24000
Arsenic	68	260	3200	2900	1800	3200	36	170	200	200	380	260	290
Barium	47.4	173	210	210	160	280	10.3	210	310	176	186	76.3	202
Beryllium	0.4	1.36	<0.78	<0.78	<0.78	<0.78	<0.078	1.15	1.82	2.19	2.36	0.895	2.72
Cadmium	<0.424	21	34	53	33	55	4.38	60.2	18.3	23.7	12.7	4.93	53.4
Calcium	2600	7000	12000	13000	<1300	<1300	690	6100	6400	8100	7800	2900	10000
Chromium	270	37800	310	390	<39	<39	270	950	5400	6900	10000	4700	9300
Copper	39.7	119	<20	<20	<20	<20	6.01	54.6	132	113	122	60.9	128
Iron	14000	4300	280000	330000	50000	34000	4000	73000	45000	33000	33000	19000	36000
Lead	60.1	338	30.7	39.2	46.5	31.8	31	202	612	439	542	134	632
Magnesium	4300	3050	550	730	2600	850	164	6900	3800	2580	3090	2400	2880
Manganese	280	<84	3800	3900	<84	<84	100	8800	3400	1500	1400	310	1600
Mercury	1	27	2.1	1.7	0.55	3.5	3.5	6.07	33	53	130	72	38
Nickel	11.6	69.7	<25	<25	<25	<25	6.77	70.1	64.9	79.3	53.5	12.4	75.4
Potassium	2200	1520	185	244	996	324	90.5	2340	1740	1210	1310	704	1330
Sodium	238	<52	<520	<520	<520	<520	123	<52	799	896	588	266	825
Vanadium	20.1	76.3	<13	<13	<13	<13	8.79	74.8	150	166	102	24.3	165
Zinc	<80	<80	<80	<80	<80	<80	42.8	<80	<80	<80	<80	<80	<80

TABLE B-3
Plow Shop Pond Sediment Metals Concentration in mg/kg dw

	1/1/1992												
	SHD-92-01X	SHD-92-02X	SHD-92-03X	SHD-92-04X	SHD-92-05X	SHD-92-06X	SHD-92-07X	SHD-92-08X	SHD-92-09X	SHD-92-10X	SHD-92-11X	SHD-92-12X	SHD-92-13X
Aluminum	4590	8470	1900	2970	6310	6520	1290	1590	859	388	8150	9250	7360
Arsenic	510	340	120	500	91.8	210	48	86	44.3	3.49	260	420	340
Barium	113	344	62.5	122	116	274	27	42.7	34	<5.18	89.1	121	93.4
Beryllium	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium	<0.7	<0.7	<0.7	<0.7	<0.7	19.2	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Calcium	20100	13300	5860	14700	17700	11700	5850	12200	7940	6850	8210	8410	3290
Chromium	72.8	2400	335	600	773	1870	169	416	188	<4.05	1590	3400	5250
Cobalt	<1.42	58.7	<1.42	<1.42	<1.42	22.4	<1.42	<1.42	<1.42	<1.42	<1.42	<1.42	10.2
Copper	<0.965	105	<0.965	<0.965	37.6	56	5.08	9.53	<0.965	<0.965	99.5	50.4	66.7
Iron	46100	68400	15100	52600	14400	25500	2940	5240	5010	428	16400	18600	15700
Lead	8.63	132	6.82	41.5	37.3	113	5.51	19.3	7.13	<0.177	260	108	160
Magnesium	1800	1700	<100	950	1380	1470	471	727	551	<100	2060	1800	1630
Manganese	1690	54800	973	3670	2410	5500	270		281	<2.05	218	608	342
Mercury	<0.05	16	1.79	7.37	2.61	18	0.646	3.05	1.15	<0.05	22	22	89
Nickel	<1.71	70.1	<1.71	<1.71	25.8	55.6	<1.71	<1.71	<1.71	<1.71	27.9	31	22.1
Potassium	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	817
Selenium	3.54	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.1	<0.25	<0.25	5.85	<0.25	2.77
Silver			<0.0061					<0.0061					
Sodium	1790	2240	786	1640	1940	2030	646	1000	924	574	1600	2000	792
Vanadium	<3.39	61.7	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	21.6
Zinc	<8.03	370	<8.03	<8.03	147	403	<8.03	<8.03	<8.03	<8.03	204	221	248
	1/1/1992 (cont.)												
	SHD-92-14X	SHD-92-15X	SHD-92-16X	SHD-92-17X	SHD-92-18X	SHD-92-19X	SHD-92-20X	SHD-92-21X	SHD-92-22X	SHD-92-23X	SHD-92-24X	SHD-92-25X	SHD-92-26X
Aluminum	4280	5460	9920	2790	4010	4150	6620	9980	7310	9760	3890	4150	6600
Arsenic	390	300	320	97.9	170	11	150	340	190	470	150	7.53	170
Barium	52.6	79.8	96.8	<5.18	<5.18	31.7	46.8	94.6	46.8	68.1	33.8	18.1	79.9
Beryllium	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Calcium	11100	16200	8950	18200	13300	1190	2360	8350	9950	8850	4140	4080	3050
Chromium	797	2130	6170	301	90.3	110	1190	4100	467	1510	1050	24.5	3060
Cobalt	<1.42	<1.42	<1.42	<1.42	<1.42	3.52	10.1	<1.42	<1.42	<1.42	<1.42	<1.42	12.6
Copper	20	33.4	72.8	<0.965	<0.965	22.3	22.4	54.3	12.3	29.5	13.8	3.55	58.3
Iron	12300	18100	24200	8420	13100	16000	10200	18600	10100	15300	6780	1770	21600
Lead	31.7	102	200	17.2	30.6	25	63	170	34.1	180	40.7	3.88	160
Magnesium	<100	1540	2120	1460	<100	1500	1700	1820	1370	1900	737	699	1410
Manganese	681	1040	826	1000	1420	148	342	785	520	663	336	123	967
Mercury	6.05	19	77	4.64	0.695	0.195	21	<0.05	1.84	18	8.8	<0.05	31
Nickel	<1.71	<1.71	38.2	<1.71	<1.71	13.8	15.3	29.6	<1.71	23.9	11.6	7.26	18.9
Potassium	<100	<100	<100	<100	<100	270	768	<100	<100	<100	<100	<100	572
Selenium	<0.25	<0.25	6.62	<0.25	<0.25	0.698	2.34	3.91	2.33	6.37	1.94	1.67	2.52
Silver	<0.0061												
Sodium	1770	2870	2240	2740	2460	274	648	1810	1290	2360	1350	518	899
Vanadium	<3.39	<3.39	<3.39	<3.39	<3.39	9.14	13.7	<3.39	<3.39	<3.39	<3.39	<3.39	21.8
Zinc	<8.03	188	373	<8.03	<8.03	59.1	91.6	252	<8.03	126	65.3	<8.03	203

TABLE B-3
Plow Shop Pond Sediment Metals Concentration in mg/kg dw

	1/1/1992 (cont.)					
	SHD-92-27X	SHD-92-28X	SHD-92-29X	SHD-92-30X	SHD-92-31X	SHD-92-32X
Aluminum	13500	3050	6660	9070	14500	8680
Arsenic	150	310	20	18.8	28	18.1
Barium	45.9	24.1	23.3	30.8	43.7	55.4
Beryllium	<0.5	<0.5	<0.5	<0.5	1.25	<0.5
Cadmium	<0.7	<0.7				
Calcium	3650	5180	1010	1770	2850	904
Chromium	1060	132	89.5	51	31.8	22.7
Cobalt	22.4	50.8	2.67	3.46	6.51	3.15
Copper	23.6	7.58	9.54	14.8	17.6	13.1
Iron	19400	51300	6870	9330	14600	8470
Lead	100	37	42	57	39	82
Magnesium	2110	703	1000	1580	3230	816
Manganese	600	2370	212	175	340	103
Mercury	5	0.294	1.9	0.966	0.582	0.57
Nickel	24.8	29.9	7.55	10.1	18.7	9.53
Potassium	<100	<100	223	464	1150	295
Selenium	<0.25	<0.25	<0.25	0.677	<0.25	0.679
Silver			<0.589	<0.589	<0.589	1.22
Sodium	1120	482	274	364	334	343
Vanadium	30.5	<3.39	13.2	18.5	21.7	14.9
Zinc	83.4	27.5	22.3	33.9	56.9	77.7
	1/1/1994					
	RHD-94-02X	RHD-94-03X	RHD-94-04X	RHD-94-05X		
Aluminum	20500	5710	2180	6690		
Antimony	17.6	12.3	<1.09	19.6		
Arsenic	9.88	16	23.1	14.7		
Barium	290	113	<5.18	76		
Beryllium	2.69	1.07	<0.5	1.76		
Calcium	20600	2670	24700	3940		
Chromium	14.8	15.4	<4.05	79.4		
Cobalt	4.93	4.07	<1.42	5.81		
Copper	3450	276	17.2	1750		
Iron	11400	14400	4220	52900		
Lead	945	344	10.5	1210		
Magnesium	1820	1560	13.6	1120		
Manganese	59	74.8	268	153		
Mercury	0.116	0.312	<0.05	0.496		
Nickel	14.8	13.2	<1.71	19.1		
Potassium	1870	387	<100	443		
Selenium	0.814	2.32	<0.25	1.77		
Silver	1.13	<0.589	<0.589	0.589		
Sodium	1290	632	2880	777		
Vanadium	28.1	14	<3.39	19		
Zinc	84	96.2	<8.03	141		

TABLE B-3
Plow Shop Pond Sediment Metals Concentration in mg/kg dw

	4/1/1995												
	SHD-94-01X	SHD-94-02X	SHD-94-03X	SHD-94-04X	SHD-94-05X	SHD-94-06X	SHD-94-07X	SHD-94-08X	SHD-94-09X	SHD-94-10X	SHD-94-11X	SHD-94-12X	SHD-94-13X
Aluminum	3940	11800	9430	9650	9440	3200	4560	9520	11300	12500	9840	8510	11200
Antimony	<1.09	<1.09	30.7	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09
Arsenic	170	200	120	310	390	1100	2700	570	180	650	280	390	390
Barium	48.2	151	152	<5.18	105	164	172	99.4	82.9	114	72.5	75.1	102
Beryllium								<0.5					
Cadmium	<0.7	12.9	<0.7	14.4	<0.7	5.31	<0.7	16	<0.7	13.3	<0.7	<0.7	<0.7
Calcium	3350	5070	7020	6410	11900	17200	12900	7480	4920	6320	4620	8000	5430
Chromium	906	4090	3840	4830	5230	148	2350	4010	3130	8880	2120	3230	6690
Cobalt	14.3	24	24.8	<1.42	24.1	<1.42	18.7	<1.42	16.4	21.3	10.8	<1.42	<1.42
Copper	45.7	265	2090	125	75.1	24.2	37.1	81.9	266	124	42.8	57.3	88.5
Iron	18700	34500	38500	21400	40300	281000	266000	36900	27900	27700	18300	23100	26500
Lead	79	22	1000	250	190	27.8	75.8	230	330	250	79	120	210
Magnesium	695	2900	1840	1990	1910	935	1040	2060	2790	2530	2310	1830	2300
Manganese	11200	3430	377	467	2150	9780	5330	884	228	772	690		683
Mercury	2.92	38	6.5	47	64	<0.05	13	100	50	97	19	86	250
Nickel	23.4	62	87.8	39.7	35.4	<1.71	23.4	44.6	46.7	52	20.8	28.2	34.5
Potassium	<100	1310	<100	<100	<100	<100	<100	<100	803	1180	1080	<100	<100
Selenium	<0.25	<0.25	5.35	<0.25	<0.25	<0.25	<0.25	<0.25	4.86	4.84	2.53	<0.25	5.97
Silver								<0.589				<0.589	
Sodium	1810	3840	2980	4440	3510	2290	2840	5280	2430	4000	1810	2760	3240
Thallium								<0.5				<0.5	
Vanadium	25.7	60.2	112	50.7	43.3	<3.39	33	<3.39	50	55.1	<3.39	<3.39	<3.39
Zinc	97.5	528	743	418	363	88.7	174	400	626	528	139	225	341
	4/1/1995 (cont.)												
	SHD-94-14X	SHD-94-15X	SHD-94-16X	SHD-94-17X	SHD-94-18X	SHD-94-19X	SHD-94-20X	SHD-94-21X	SHD-94-22X				
Aluminum	9830	11500	14100	11200	8830	13200	9020	14600	13400				
Antimony	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09	<1.09				
Arsenic	320	9.76	410	390	300	250	510	650	400				
Barium	124	65.7	117	103	93.6	134	80.3	133	129				
Beryllium						<0.5							
Cadmium	12.4	<0.7	<0.7	11.8	5.53	<0.7	<0.7	<0.7	<0.7				
Calcium	6110	32700	7560	7590	3600	9560	4260	6640	5500				
Chromium	4720	146	6540	4150	3860	3810	3240	7070	3260				
Cobalt	<1.42	5.64	18.1	<1.42	12.4	<1.42	16.3	19.6	15.8				
Copper	81.3	20.9	84.3	71.4	61.9	67.1	19.4	99.5	84				
Iron	33200	69700	27400	26100	19600	27100	24700	28500	28200				
Lead	200	16.4	240	210	170	79.5	190	250	220				
Magnesium	1950	8580	2480	2080	1460	2260	1730	2640	2670				
Manganese	1070	5690	793	1250	979	1560	685	1390	2260				
Mercury	88	0.22	81	45	52	35	37	150	170				
Nickel	57.2	38.3	42.9	42.1	32.1	43.8	36.3	40.4	33.6				
Potassium	<100	272	<100	<100	<100	<100	863	1150	1130				
Selenium	<0.25	<0.25	4.64	<0.25	3.37	<2.0975	3.85	4.4	3.31				
Silver						<0.589							
Sodium	4280	481	2980	4180	1960	3650	2800	3210	2810				
Thallium						<0.5							
Vanadium	<3.39	37.8	43	<3.39	33.7	<3.39	47.1	<3.39	<3.39				
Zinc	438	48.2	381	348	310	326	316	392	314				

TABLE B-3
Plow Shop Pond Sediment Metals Concentration in mg/kg dw

	9/11/1998												
	PSEM-1	PSEM-2	PSEM-3										
Aluminum	1.2	1.3	1										
Antimony	<7	<5	<5										
Arsenic	300	160	160										
Barium	115	113	96.9										
Beryllium	1.5	1.5	1.4										
Cadmium	7	3.8	12.3										
Calcium	0.41	0.39	0.64										
Chromium	5220	2720	2800										
Cobalt	18.9	17	19.7										
Copper	68.2	134	177										
Iron	3.3	2.8	2.5										
Lead	258	426	286										
Magnesium	1680	3100	1910										
Manganese	1030	677	645										
Nickel	37.5	42.2	46.5										
Potassium	690	1450	841										
Selenium	14.7	9.8	10.4										
Silver	2	2	2										
Sodium	317	381	358										
Thallium	29.4	19.7	20.9										
Vanadium	36.4	56.3	47										
Zinc	336	558	391										
	9/1/2000												
	PSPCORE1	PSPCORE2	PSPCORE3										
Arsenic	323.38	289.7323	252.66										
Cadmium	6.054	9.195	9.88										
Chromium	2857.56	4209.184	5493.285										
Copper	50.15	76.606	73.7										
Lead	156.825	251.74	249.39										
Manganese	1826.5	1228.677	820.807										
Mercury	46.35	96.78	97.2										
Nickel	29.8	44.403	41.469										
Zinc	233.25	343.936	360.4231										
	1/1/2001												
	PS1	PS2	PS3	PS4	PS5	PS6	PS7	PS8	PS9	PS10			
Arsenic	256.67	1767.03	210.62	90.41	114.27	70.36	164.79	245.79	220.4	2891.98			
Cadmium	8.92	4.213	13.852	6.145	0.792	3.945	3.892	6.45	12.708	2.54			
Chromium	3541.52	650.27	3534.16	1203.78	454.17	1347.15	1529.4	2641.65	4080.97	946.98			
Lead	1214.31	67.57	218.25	278.28	31.5	76.49	141.75	157.91	220.95	58.41			
Mercury	47.42	4.06	45.36	14.957	2.323	25.326	25.631	49.076	58.548	20.148			
Methyl mercury	0.06538	0.0057	0.08189	0.05299	0.00928	0.02748	0.03476	0.02538	0.06255	0.00113			
	3/2/2004												
	PSP01	PSP02	PSP03	PSP04	PSP05	PSP06	PSP07	PSP08	PSP09				
Aluminum	12000	11000	7300	8800	6500	880	6700	4100	9100				
Antimony	<10	<10	<11	<10	<10	<100	<10	<10	<10				
Arsenic	190	200	140	120	220	3900	240	26	97				
Barium	130	200	180	93	100	280	61	24	62				
Beryllium	1.6	1.4	<1.1	<1	<1	<10	<1	<1	<1				
Cadmium	30	25	24	18	18	<30	19	<3	12				
Calcium	6500	5700	4900	5400	4600	12000	6900	1000	6300				
Chromium	5100	2700	1100	930	1100	38	960	11	390				
Cobalt	29	25	21	18	16	<30	14	3.7	10				

TABLE B-3
Plow Shop Pond Sediment Metals Concentration in mg/kg dw

Copper	89	81	64	72	45	<30	53	12	220				
Iron	29000	38000	36000	23000	28000	410000	24000	6300	15000				
Lead	320	300	180	140	120	<100	130	14	190				
Magnesium	1900	2000	1500	2000	1300	500	1500	1500	2300				
Manganese	760	3100	4100	910	980	2400	650	230	130				
Mercury	48	22	8.3	8.4	8.6	0.21	6.7	0.038	1.9				
Nickel	69	73	63	43	37	<60	38	10	39				
Potassium	<1000	1000	<1100	<1000	<1000	<10000	<1000	<1000	<1000				
Selenium	<10	<10	<11	<10	<10	<100	<10	<10	<10				
Silver	<3	<3	<3.3	<3	<3	<30	<3	<3	<3				
Sodium	1200	1300	1300	1100	<1000	<10000	<1000	<1000	<1000				
Thallium	<20	<20	<22	<20	<20	<200	<20	<20	<20				
Vanadium	76	80	48	36	34	<30	37	7.1	35				
Zinc	600	560	480	400	330	62	340	32	290				
	3/3/2004												
	PSPC09	PSPC10											
Aluminum	9700	4600											
Antimony	<50	<9											
Arsenic	100	54											
Barium	70	27											
Beryllium	1.4	<0.9											
Cadmium	4.1	<2.7											
Calcium	19000	1200											
Chromium	1400	44											
Cobalt	12	5.1											
Copper	310	13											
Iron	18000	8200											
Lead	320	16											
Magnesium	2200	1700											
Manganese	150	1100											
Mercury	16	0.2											
Nickel	28	12											
Potassium	<5000	<900											
Selenium	<50	<9											
Silver	<15	<2.7											
Sodium	<5000	<900											
Thallium	<100	<18											
Vanadium	38	8.4											
Zinc	320	34											
	3/4/2004												
	PSPC10	PSPC11	PSPC12	PSPC13	PSPC14								
Aluminum	5700	2800	9700	11000	29000								
Antimony	<10	<50	<48	<98	<200								
Arsenic	110	<50	280	2000	6800								
Barium	51	34	44	45	370								
Beryllium	<1	<5	1.5	<9.8	<20								
Cadmium	<3	<15	19	<29	66								
Calcium	7100	19000	10000	34000	13000								
Chromium	510	140	3600	490	190								
Cobalt	6.3	<15	20	59	19								
Copper	29	<15	61	4.4	39								
Iron	9500	6200	28000	290000	390000								
Lead	60	<50	180	<98	70								
Magnesium	1200	960	2100	1100	5300								
Manganese	720	1100	620	34000	1800								
Mercury	5.7	1.6	41	2.4	2.4								
Nickel	10	<30	63	8.6	37								
Potassium	<1000	<5000	<4800	<9800	<10000								
Selenium	<10	<50	<48	<98	<400								
Silver	<3	<15	<14	<29	<60								
Sodium	<1000	<5000	<4800	<9800	<10000								
Thallium	<20	<100	<96	<200	<400								
Vanadium	12	<15	40	<29	39								
Zinc	62	25	490	94	97								

TABLE B-3
Plow Shop Pond Sediment Metals Concentration in mg/kg dw

	3/5/2004										
	PSPC05	PSPC06	PSPC15	PSPC16	PSPC17	PSPC18	PSPC19				
Aluminum	3800	5200	14000	7700	8600	3800	2100				
Antimony	<16	<50	<10	<9.8	<50	<50	<500				
Arsenic	170	2500	310	57	490	940	3500				
Barium	72	150	130	42	110	140	150				
Beryllium	<1.6	<5	1.3	<0.98	1	<5	<50				
Cadmium	<4.8	27	17	4	24	<15	<150				
Calcium	16000	12000	5600	2200	7300	8900	9900				
Chromium	560	2400	5700	1040	3300	170	<150				
Cobalt	6.1	33	22	6.9	20	<15	<150				
Copper	14	42	73	21	50	32	<150				
Iron	23000	220000	45000	11000	93000	230000	360000				
Lead	37	140	260	76	140	<60	<500				
Magnesium	950	980	2000	1500	1400	840	960				
Manganese	1100	4700	4500	340	4800	5200	2200				
Mercury	6.1	36	117	12	96	0.8	0.12				
Nickel	10	<30	42	19	57	<30	<300				
Potassium	<1600	<2500	740	<490	<5000	<5000	<50000				
Selenium	<32	<100	<20	<9.8	<100	<100	<1000				
Silver	<4.8	<15	<3	<2.9	<15	<15	<150				
Sodium	<1600	<2500	1100	<490	<2500	<5000	<50000				
Thallium	<32	<100	<20	<20	<100	<150	<1000				
Vanadium	9.5	19	51	19	40	<15	<150				
Zinc	56	190	380	110	400	140	<150				
	2/1/2005										
	P-SED-1	P-SED-2	P-SED-10	P-SED-11	P-SED-3	P-SED-4	P-SED-5	P-SED-6	P-SED-7	P-SED-8	P-SED-9
Aluminum	14000	5500	11000	2700	27000	1900	8600	11000	12000	10000	10000
Antimony	<12	<110	<9.3	<100	<10	<96	17	<12	<22	<12	<9.3
Arsenic	410	2800	260	1800	310	4300	310	290	270	210	130
Barium	180	270	110	120	97	220	84	68	90	100	120
Beryllium	1.8	<11	1.4	<10	1.2	<9.6	<1.7	1.2	<2.2	<1.2	2.1
Cadmium	16	36	15	23	3.6	50	7	6.5	13	9.9	9.2
Calcium	7100	15000	4500	15000	3600	14000	12000	8600	6800	4800	5400
Chromium	6200	2300	4200	330	70	410	2600	4300	4600	1800	1700
Cobalt	27	22	22	28	15	20	16	19	22	19	16
Copper	95	48	88	<31	33	<29	45	68	84	150	830
Iron	54000	360000	24000	280000	44000	370000	27000	23000	21000	22000	27000
Lead	320	160	240	<100	50	<96	130	200	270	220	700
Magnesium	2100	1100	2000	660	5000	630	1500	1800	2100	2300	3700
Manganese	3300	5300	790	14000	780	5300	940	530	560	1200	220
Mercury	93	26	56	3.2	0.47	2.6	40	78	56	22	18
Nickel	54	24	41	14	33	13	26	33	39	48	41
Potassium	1100	1500	900	1100		1600	750	830	960	890	700
Selenium	<24	<22	<19	<210	<20	<19	<34	<23	<43	<24	<19
Silver	<3.7	<33	<2.8	<31	<3.1	<29	<5.2	<3.5	<6.5	<3.6	<2.8
Sodium	940	530	570	<5200		<480	670	<580	<1100	830	<470
Thallium	<80	<220	<60	<210	<100	<400	<60	<60	<43	<60	<60
Vanadium	62	<33	40	<31	34	<29	26	36	50	35	56
Zinc	500	200	370	97	71	77	200	280	370	320	1100

TABLE B-4
Plow Shop Pond Sediment SVOCs
Concentrations in mg/kg dw

Summary Statistics

Analyte	Max (mg/kg)	Avg (mg/kg)	Frequency of Detection
2-Methylnaphthalene	2	1.28	3 of 4
Acenaphthene	0.4	0.14	11 of 15
Acenaphthylene	0.71	0.20	11 of 11
Anthracene	3.4	0.48	12 of 15
Benzo(a)anthracene	7.1	0.70	13 of 28
Benzo(a)pyrene	6.5	1.24	11 of 11
Benzo(b)fluoranthene	11	1.93	12 of 15
Benzo(ghi)perylene	5.2	1.20	11 of 11
Benzo(k)fluoranthene	3.7	0.73	12 of 15
Chrysene	8.1	0.94	13 of 28
Dibenzo(a,h)anthracene	1.3	0.31	11 of 11
Dibenzofuran	0.8	0.35	2 of 4
Fluoranthene	18	1.71	14 of 28
Fluorene	1.9	0.30	12 of 15
Indeno(1,2,3-cd)pyrene	4.5	1.03	11 of 11
Naphthalene	2.4	0.50	15 of 28
Phenanthrene	10	1.04	15 of 28
Pyrene	14	1.66	17 of 28
PAH (Total)	98.65	10.07	NA

	1/1/1991												
	SESHL01	SESHL02	SESHL03	SESHL04	SESHL05	SESHL06	SESHL07	SESHL08	SESHL09	SESHL10	SESHL11	SESHL12	SESHL13
2-Methylnaphthalene													
Acenaphthene													
Acenaphthylene													
Anthracene													
Benzo(a)anthracene	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	1.1	<0.3
Benzo(a)pyrene													
Benzo(b)fluoranthene													
Benzo(ghi)perylene													
Benzo(k)fluoranthene													
Chrysene	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	1.5	<0.45
Dibenzo(a,h)anthracene													
Dibenzofuran													
Fluoranthene	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	3.4	<0.52
Fluorene													
Indeno(1,2,3-cd)pyrene													
Naphthalene	<0.42	<0.42	<0.42	<0.42	<0.42	<0.42	<0.42	<0.42	<0.42	<0.42	<0.42	1.6	<0.42
Phenanthrene	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	2.5	<0.41
Pyrene	<0.42	<0.42	<0.42	<0.42	<0.42	<0.42	<0.42	<0.42	4.35	<0.42	3.5	2.6	<0.42
PAH (Total)	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	5.40	1.26	4.55	12.70	1.26

	1/1/1994				2/1/2005										
	RHD-94-02X	RHD-94-03X	RHD-94-04X	RHD-94-05X	P-SED-1	P-SED-2	P-SED-3	P-SED-4	P-SED-5	P-SED-6	P-SED-7	P-SED-8	P-SED-9	P-SED-10	P-SED-11
2-Methylnaphthalene	2	2	<0.2	1											
Acenaphthene	<0.2	0.4	<0.2	<0.2	0.072	0.023	<0.0091	0.0063	0.039	0.083	0.088	0.085	0.84	0.085	0.0091
Acenaphthylene					0.24	0.095	0.026	0.031	0.098	0.2	0.31	0.18	0.71	0.32	0.036
Anthracene	<0.2	0.8	<0.2	<0.2	0.4	0.14	0.13	0.038	0.17	0.39	0.49	0.36	3.4	0.54	0.052
Benzo(a)anthracene	<0.8	2	<0.8	<0.8	1	0.37	0.14	0.09	0.43	0.98	1.2	0.91	7.1	1.2	0.11
Benzo(a)pyrene					1.2	0.42	0.25	0.12	0.5	1	1.3	0.97	6.5	1.3	0.13
Benzo(b)fluoranthene	<1	2	<1	<1	2.3	0.86	0.12	0.24	0.98	2	2.9	1.8	11	2.9	0.29
Benzo(ghi)perylene					1.4	0.5	0.072	0.12	0.62	1.2	1.5	1	5.2	1.4	0.14
Benzo(k)fluoranthene	<0.3	2	<0.3	<0.3	0.85	0.26	0.18	0.071	0.3	0.72	0.93	0.63	3.7	0.72	0.085
Chrysene	<0.6	3	<0.6	<0.6	1.7	0.63	0.032	0.18	0.69	1.5	1.9	1.3	8.1	2	0.21
Dibenzo(a,h)anthracene					0.31	0.11	0.26	0.028	0.13	0.27	0.34	0.24	1.3	0.35	0.033
Dibenzofuran	0.4	0.8	<0.2	<0.2											
Fluoranthene	<0.3	5	<0.3	1	2.9	0.98	0.013	0.27	1.2	2.7	3.3	2.2	18	3.2	0.35
Fluorene	<0.2	0.4	<0.2	<0.2	0.28	0.089	0.11	0.025	0.16	0.31	0.35	0.23	1.9	0.31	0.031
Indeno(1,2,3-cd)pyrene					1.2	0.44	0.048	0.11	0.5	1	1.3	0.89	4.5	1.2	0.12
Naphthalene	2	2	<0.2	0.7	0.34	0.11	0.12	0.024	0.2	0.41	0.43	0.38	2.4	0.57	0.081
Phenanthrene	0.8	4	<0.2	1	1.2	0.42	0.24	0.13	0.6	1.3	1.5	1.2	10	1.4	0.15
Pyrene	0.5	3	<0.2	0.8	2.3	0.83	1.8	0.24	1	2.1	2.6	1.8	14	2.5	0.27
PAH (Total)	5.50	25.40	2.20	5.25	17.69	6.28	3.55	1.72	7.62	16.16	20.44	14.18	98.65	20.00	2.10

TABLE B-5
Plow Shop Pond Sediment Pesticides and PCBs
Concentrations in mg/kg

Summary Stats

	Max concentration (mg/Kg)	Average concentration (mg/Kg)	Frequency of Detection
4,4'-DDD	1.8	0.08	15/40
4,4'-DDE	1.3	0.06	20/59
4,4'-DDT	0.13	0.01	10/46
Aroclor 1242	0.092	0.05	1/11
Aroclor 1254	0.11	0.05	1/11
Aroclor 1260	0.13	0.04	1/11
Heptachlor	0.05	0.01	2/24

	1/1/1991													
	SESHL01	SESHL02	SESHL03	SESHL04	SESHL05	SESHL06	SESHL07	SESHL08	SESHL09	SESHL10	SESHL11	SESHL12	SESHL13	
4,4'-DDE	<0.04	<0.04	0.172	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	
Heptachlor	<0.012	0.02	0.092	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	
	1/1/1992													
	SHD-92-01X	SHD-92-02X	SHD-92-03X	SHD-92-04X	SHD-92-05X	SHD-92-06X	SHD-92-07X	SHD-92-08X	SHD-92-09X	SHD-92-10X	SHD-92-11X	SHD-92-12X	SHD-92-13X	SHD-92-14X
4,4'-DDD	<0.008	1.8	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
4,4'-DDE	<0.008	1.3	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	0.074	<0.008	<0.008	<0.008
4,4'-DDT	<0.007	<0.071	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007
	1/1/1992 (cont.)													
	SHD-92-15X	SHD-92-16X	SHD-92-17X	SHD-92-18X	SHD-92-19X	SHD-92-20X	SHD-92-21X	SHD-92-22X	SHD-92-23X	SHD-92-24X	SHD-92-25X	SHD-92-26X	SHD-92-27X	SHD-92-28X
4,4'-DDD	<0.008	<0.008	<0.008	<0.008	0.017	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	0.18	0.28
4,4'-DDE	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	0.133	<0.008	<0.008	<0.008	<0.008	0.075	0.041
4,4'-DDT	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	0.13
	1/1/1993													
	SHD-92-29X	SHD-92-30X	SHD-92-31X	SHD-92-32X										
4,4'-DDE	<0.076	<0.076	0.03	0.17										
4,4'-DDT	<0.071	<0.071	0.015	0.042										
	2/1/2005													
	P-SED-1	P-SED-2	P-SED-3	P-SED-4	P-SED-5	P-SED-6	P-SED-7	P-SED-8	P-SED-9	P-SED-10	P-SED-11			
4,4'-DDD	0.071	0.038	0.034	0.019	0.055	0.055	0.087	0.43	0.040	0.039	0.084			
4,4'-DDE	0.13	0.059	0.037	0.028	0.062	0.083	0.13	0.40	0.063	0.076	0.054			
4,4'-DDT	<0.0065	<0.0033	<0.0017	0.0033	<0.0030	<0.0051	0.0065	0.047	0.0044	0.0063	0.0036			
Aroclor 1242	<0.13	<0.068	0.11	<0.058	<0.061	<0.1	<0.12	<0.092	<0.053	<0.09	<0.068			
Aroclor 1254	<0.13	<0.068	0.13	<0.058	<0.061	<0.1	<0.12	<0.092	<0.053	<0.09	<0.068			
Aroclor 1260	<0.13	<0.068	0.05	<0.058	<0.061	<0.1	<0.12	<0.092	<0.053	<0.09	<0.068			
Heptachlor	<0.0065	<0.0033	<0.0017	<0.0028	<0.0030	<0.0051	<0.0060	<0.0045	<0.0026	<0.0044	<0.0033			

TABLE B-6
Plow ShopPond Sediment VOCs
Concentration in mg/kg dw

Summary Statistics

Analyte	Max (mg/kg)	Avg (mg/kg)	Frequency of Detection
Acetone	2.6	0.0105	9/13
Methyl ethyl ketone	0.13	0.005	5/13
Methylene chloride	0.12	0.003	11/13

	1/1/1991												
name	SESHL01	SESHL02	SESHL03	SESHL04	SESHL05	SESHL06	SESHL07	SESHL08	SESHL09	SESHL10	SESHL11	SESHL12	SESHL13
Acetone	0.058	<0.01	0.29	0.15	0.54	<0.01	<0.01	0.37	0.4	0.15	0.15	<0.054	2.6
Methyl ethyl ketone	<0.01	<0.01	0.079	<0.01	0.13	0.089	0.023	<0.01	0.13	<0.01	<0.01	<0.01	<0.01
Methylene chloride	0.023	<0.006	0.05	0.053	0.036	0.082	0.034	0.072	0.12	<0.006	0.073	0.021	0.098

TABLE B-7
Plow Shop Pond Fish Tissue Data
Whol Body Concentrations in mg/kg ww

				10/20/1992																		
Summary Stats				Bluegill	Bluegill	Bluegill	Bullhead	Bullhead	Bullhead	Bluegill	Bluegill	LMBass	LMBass	LMBass	LMBass	LMBass	Bullhead	Bullhead	**6/24/2004**			
Chemical	**Max concentration (mg/Kg)**	**Average concentration (mg/Kg)**	**Frequency of Detection**	PSP02W	PSP03W	PSP04W	PSP05W	PSP06W	PSP12W	PSP10W	PSP11W	PSP07W	PSP17W	PSP18W	PSP19W	PSP20W	PSP22W	PSP23W	Plow-North-BGSF-WB	Plow-North-BLCR-WB	Plow-South-BGSF-WB	Plow-South-BLCR-WB
Aluminum	4.5	1.99	13/19	1.8		1.6	2.4	2.9	1.7	3.2	4.5	2.9	<1.3	<1.3	<1.3	2.1	<1.3	<1.3	2.7	1.9	2.9	3.3
Antimony	ND	ND	0/20	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<0.89	<0.73	<0.84	<0.81
Arsenic	1.3	0.32	2/20	1.3	<0.2	<0.19	<0.16	<0.16	<0.19	<0.16	<0.16	<0.2	<0.19	<0.2	<0.19	<0.19	<0.16	0.3	<1.8	<1.5	<1.7	<1.6
Barium	4.4	1.47	19/20	1.9	1.3	2.4	0.5	0.83	1	4.4	3.8	0.41	0.27	0.6	0.99	0.63	0.33	1.3	2.5	1.7	3.3	1.2
Beryllium	ND	ND	0/20	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.089	<0.073	<0.084	<0.081
Cadmium	0.09	0.05	1/20	<0.07	<0.07	<0.06	<0.07	<0.06	<0.06	<0.06	<0.07	0.09	<0.06	<0.07	<0.07	<0.06	<0.07	<0.06	<0.27	<0.22	<0.25	<0.24
Calcium	48800	15527	16/20	34600	23300	28200	8020	14600	16500	48800	24800	35900	19400	18800	12300	14100	3250	7870	<1.8	<1.5	<1.7	<1.6
Chromium	0.99	0.52	18/20	0.49	0.48	0.59	0.31	0.99	0.43	0.93	0.79	0.65	0.42	0.44	0.32	0.33	<0.2	0.25	0.62	0.65	0.79	0.63
Cobalt	0.17	0.09	5/20	0.12	0.11	0.16	0.17	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.27	<0.22	<0.25	<0.24
Copper	1.3	0.56	20/20	0.48	0.54	0.47	1.3	0.81	0.69	0.44	0.6	0.44	0.45	0.55	0.9	0.54	0.56	0.43	0.59	0.44	0.52	0.29
Iron	130	40	20/20	130	42.4	61.5	22.3	43.6	32.1	75.2	89.5	12.6	11.1	13.3	24.6	19.9	25.9	71.2	38	11	56	14
Lead	0.18	0.22	3/20	0.1	<0.1	<0.1	0.18	<0.1	<0.1	0.16	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.8	<1.5	<1.7	<1.6
Magnesium	754	477	20/20	525	496	536	296	427	459	754	529	671	508	522	420	431	249	303	500	540	610	510
Manganese	94.7	29	19/20	39.1	40.2	58.8	6.5	10.6	16	94.7	83.2	5.1	5.5	8.8	7.2	5.1	6.2	8	42	41	70	25
Mercury	2.7	0.60	19/20	<0.4	0.19	0.54	0.36	0.28	0.4	0.47	0.24	2.2	2.7	0.65	0.65	0.72	0.28	0.09	0.2	0.54	0.3	0.7
Nickel	0.8	0.38	1/20	0.8	<0.78	<0.76	<0.8	<0.8	<0.8	<0.8	<0.77	<0.78	<0.79	<0.78	<0.76	<0.78	<0.78	<0.8	<0.53	<0.44	<0.5	<0.48
Potassium	3400	3225	4/4																3200	3100	3400	3200
Selenium	0.67	0.38	15/20	0.52	<0.52	0.67	0.28	0.24	0.31	0.62	0.42	0.54	0.38	0.39	0.32	0.26	0.29	0.25	<0.89	<0.73	<0.84	<0.81
Silver	ND	ND	0/20	<0.2	<0.2	<0.19	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.19	<0.2	<0.2	<0.2	<0.27	<0.22	<0.25	<0.24
Sodium	2290	1406	20/20	1820	1530	1850	1190	1230	1410	2290	1480	2020	1340	1460	1530	1460	1080	1120	1100	1200	1400	1200
Thallium	ND	ND	0/20	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.8	<1.5	<1.7	<1.6
Vanadium	0.8	0.36	1/20	0.8	<0.78	<0.76	<0.8	<0.8	<0.8	<0.8	<0.77	<0.78	<0.79	<0.78	<0.76	<0.78	<0.78	<0.8	<0.27	<0.22	<0.25	<0.24
Zinc	29.6	19	20/20	25.1	22.2	25.6	14.1	18.8	22.3	29.6	22.6	17.9	13	16.3	15.7	18.9	14.1	12.1	25	21	27	19

TABLE B-8
Plow Shop Pond Fish Tissue Data
Summary Stats for each Fish Species Collected
Concentrations in mg/kg ww

Largemouth Bass

Chemical	Max concentration (mg/Kg)	Average concentration (mg/Kg)	Frequency of Detection
Aluminum	2.9	1.39	'2/5
Antimony	ND	ND	'0/5
Arsenic	ND	ND	'0/5
Barium	0.99	0.58	'5/5
Beryllium	ND	ND	'0/5
Cadmium	0.09	0.04	'1/5
Calcium	35900	20100.00	'5/5
Chromium	0.65	0.43	'5/5
Cobalt	ND	ND	'0/5
Copper	0.9	0.58	'5/5
Iron	24.6	16.30	'5/5
Lead	ND	ND	'0/5
Magnesium	671	510.40	'5/5
Manganese	8.8	6.34	'5/5
Mercury	2.7	1.38	'5/5
Nickel	ND	ND	'0/5
Potassium	NA	NA	NA
Selenium	0.54	0.38	'5/5
Silver	ND	ND	'0/5
Sodium	2020	1562.00	'5/5
Thallium	ND	ND	'0/5
Vanadium	ND	ND	'0/5
Zinc	18.9	16.36	'5/5
4,4'-DDD	0.11	0.05	5/5
4,4'-DDE	0.38	0.17	5/5
4,4'-DDT	0.012	0.01	1/5
Aroclor-1260	0.33	0.14	5/5

Bullhead

Chemical	Max concentration (mg/Kg)	Average concentration (mg/Kg)	Frequency of Detection
Aluminum	2.9	1.66	'3/5
Antimony	ND	ND	'0/5
Arsenic	0.3	0.13	'1/5
Barium	1.3	0.79	'5/5
Beryllium	ND	ND	'0/5
Cadmium	ND	ND	'0/5
Calcium	16500	10048.00	'5/5
Chromium	0.99	0.42	'4/5
Cobalt	0.17	0.07	'1/5
Copper	1.3	0.76	'5/5
Iron	71.2	39.02	'5/5
Lead	0.18	0.08	'1/5
Magnesium	459	346.80	'5/5
Manganese	16	9.46	'5/5
Mercury	0.4	0.28	'5/5
Nickel	ND	ND	'0/5
Potassium	NA	NA	NA
Selenium	0.31	0.27	'5/5
Silver	ND	ND	'0/5
Sodium	1410	1206.00	'5/5
Thallium	ND	ND	'0/5
Vanadium	ND	ND	'0/5
Zinc	22.3	16.28	'5/5
4,4'-DDD	0.012	0.01	1/5
4,4'-DDE	0.033	0.01	2/5
4,4'-DDT	0.014	0.01	2/5
Aroclor-1260	ND	ND	0/5

Bluegill

Chemical	Max concentration (mg/Kg)	Average concentration (mg/Kg)	Frequency of Detection
Aluminum	4.5	2.73	6/6
Antimony	ND	ND	0/7
Arsenic	1.3	0.24	1/7
Barium	4.4	2.51	7/7
Beryllium	ND	ND	0/7
Cadmium	ND	ND	0/7
Calcium	48800	20965.22	5/7
Chromium	0.93	0.63	7/7
Cobalt	0.17	0.12	4/7
Copper	1.3	0.62	7/7
Iron	130	64.36	7/7
Lead	0.18	0.29	2/7
Magnesium	754	530.75	7/7
Manganese	94.7	54.31	7/7
Mercury	0.54	0.31	6/7
Nickel	0.8	0.41	1/7
Potassium	3400	3300.00	2/2
Selenium	0.67	0.45	4/7
Silver	ND	ND	0/7
Sodium	2290	1582.50	7/7
Thallium	ND	ND	0/7
Vanadium	0.8	0.38	1/7
Zinc	29.6	23.90	7/7
4,4'-DDD	0.021	0.01	2/7
4,4'-DDE	0.16	0.05	4/7
4,4'-DDT	ND	ND	0/7
Aroclor-1260	ND	ND	0/7

Black crappie

Chemical	Max concentration (mg/Kg)	Average concentration (mg/Kg)	Frequency of Detection
Aluminum	3.3	2.60	2/2
Antimony	ND	ND	0/2
Arsenic	ND	ND	0/2
Barium	1.7	1.45	2/2
Beryllium	ND	ND	0/2
Cadmium	ND	ND	0/2
Calcium	ND	ND	0/2
Chromium	0.65	0.64	2/2
Cobalt	ND	ND	0/2
Copper	0.44	0.37	2/2
Iron	14	12.50	2/2
Lead	ND	ND	0/2
Magnesium	540	525.00	2/2
Manganese	41	33.00	2/2
Mercury	0.7	0.62	2/2
Nickel	ND	ND	0/2
Potassium	3200	3150.00	2/2
Selenium	ND	ND	0/2
Silver	ND	ND	0/2
Sodium	1200	1200.00	2/2
Thallium	ND	ND	0/2
Vanadium	ND	ND	0/2
Zinc	21	20.00	2/2
4,4'-DDD	0.037	0.03	2/2
4,4'-DDE	0.18	0.17	2/2
4,4'-DDT	ND	ND	0/2
Aroclor-1260	ND	ND	0/2

TABLE B-9
Plow Shop Pond Fish Tissue - Pesticides and PCBs
Whole body Concentrations in mg/kg ww

				ABB 1993 Fish Data.xls (collected 10/20/92)															Master-Joanne-only Fish2004.xls [Fish			
				PSP02W	PSP03W	PSP04W	PSP05W	PSP06W	PSP07W	PSP10W	PSP11W	PSP12W	PSP17W	PSP18W	PSP19W	PSP20W	PSP22W	PSP23W	Plow-North-BGSF-WB	Plow-North-BLCR-WB	Plow-South-BGSF-WB	Plow-South-BLCR-WB
Chemical	**max**	**average**	**FOD**	Bluegill	Bluegill	Bluegill	Bullhead	Bullhead	LMBass	Bluegill	Bluegill	Bullhead	LMBass	LMBass	LMBass	LMBass	Bullhead	Bullhead				
4,4'-DDD	0.11	0.02	10/19	<0.0096	<0.0097	<0.0099	<0.0097	<0.0097	0.035	<0.0096	<0.01	<0.0099	0.11	0.021	0.032	0.03	0.012	<0.0099	0.021	0.023	0.014	0.037
4,4'-DDE	0.38	0.08	13/19	<0.0096	0.029	0.021	0.015	<0.0097	0.15	<0.0096	<0.01	<0.017	0.38	0.082	0.084	0.14	0.033	<0.014	0.091	0.16	0.16	0.18
4,4'-DDT	0.014	0.01	3/19	<0.0096	<0.0097	<0.0099	0.013	0.014	<0.0098	<0.0096	<0.01	<0.0099	0.012	<0.0097	<0.0097	<0.0095	<0.01	<0.0099	<0.011	<0.011	<0.01	<0.01
aldrin	ND	ND	0/19	<0.0048	<0.0049	<0.005	<0.0049	<0.0049	<0.0049	<0.0048	<0.005	<0.005	<0.025	<0.0049	<0.0049	<0.0047	<0.005	<0.005	<0.011	<0.011	<0.01	<0.01
alpha-BHC	ND	ND	0/19	<0.0048	<0.0049	<0.005	<0.0049	<0.0049	<0.0049	<0.0048	<0.005	<0.005	<0.025	<0.0049	<0.0049	<0.0047	<0.005	<0.005	<0.011	<0.011	<0.01	<0.01
alpha-chlordane	ND	ND	0/19	<0.0048	<0.0049	<0.005	<0.0049	<0.0049	<0.0049	<0.0048	<0.005	<0.005	<0.025	<0.0049	<0.0049	<0.0047	<0.005	<0.005	<0.011	<0.011	<0.01	<0.01
Aroclor-1016	ND	ND	0/19	<0.048	<0.049	<0.05	<0.049	<0.049	<0.049	<0.048	<0.05	<0.05	<0.25	<0.049	<0.049	<0.047	<0.05	<0.05	<0.22	<0.22	<0.21	<0.21
Aroclor-1221	ND	ND	0/19	<0.048	<0.049	<0.05	<0.049	<0.049	<0.049	<0.048	<0.05	<0.05	<0.25	<0.049	<0.049	<0.047	<0.05	<0.05	<0.22	<0.22	<0.21	<0.21
Aroclor-1232	ND	ND	0/19	<0.048	<0.049	<0.05	<0.049	<0.049	<0.049	<0.048	<0.05	<0.05	<0.25	<0.049	<0.049	<0.047	<0.05	<0.05	<0.22	<0.22	<0.21	<0.21
Aroclor-1242	ND	ND	0/19	<0.048	<0.049	<0.05	<0.049	<0.049	<0.049	<0.048	<0.05	<0.05	<0.25	<0.049	<0.049	<0.047	<0.05	<0.05	<0.22	<0.22	<0.21	<0.21
Aroclor-1248	ND	ND	0/19	<0.048	<0.049	<0.05	<0.049	<0.049	<0.049	<0.048	<0.05	<0.05	<0.25	<0.049	<0.049	<0.047	<0.05	<0.05	<0.22	<0.22	<0.21	<0.21
Aroclor-1254	ND	ND	0/19	<0.048	<0.049	<0.05	<0.049	<0.049	<0.049	<0.048	<0.05	<0.05	<0.25	<0.049	<0.049	<0.047	<0.05	<0.05	<0.22	<0.22	<0.21	<0.21
Aroclor-1260	0.33	0.07	5/19	<0.048	<0.049	<0.05	<0.049	<0.049	0.13	<0.048	<0.05	<0.05	0.33	0.063	0.061	0.1	<0.05	<0.05	<0.22	<0.22	<0.21	<0.21
Aroclor-1262	ND	ND	0/4																<0.22	<0.22	<0.21	<0.21
Aroclor-1268	ND	ND	0/4																<0.22	<0.22	<0.21	<0.21
beta-BHC	ND	ND	0/19	<0.0048	<0.0049	<0.005	<0.0049	<0.0049	<0.0049	<0.0048	<0.005	<0.005	<0.025	<0.0049	<0.0049	<0.0047	<0.005	<0.005	<0.011	<0.011	<0.01	<0.01
delta-BHC	ND	ND	0/19	<0.0048	<0.0049	<0.005	<0.0049	<0.0049	<0.0049	<0.0048	<0.005	<0.005	<0.025	<0.0049	<0.0049	<0.0047	<0.005	<0.005	<0.011	<0.011	<0.01	<0.01
Dieldrin	ND	ND	0/19	<0.0096	<0.0097	<0.0099	<0.0097	<0.0097	<0.0098	<0.0096	<0.01	<0.0099	<0.05	<0.0097	<0.0097	<0.0095	<0.01	<0.0099	<0.011	<0.011	<0.01	<0.01
Endosulfan I	ND	ND	0/19	<0.0048	<0.0049	<0.005	<0.0049	<0.0049	<0.0049	<0.0048	<0.005	<0.005	<0.025	<0.0049	<0.0049	<0.0047	<0.005	<0.005	<0.011	<0.011	<0.01	<0.01
Endosulfan II	ND	ND	0/19	<0.0096	<0.0097	<0.0099	<0.0097	<0.0097	<0.0098	<0.0096	<0.01	<0.0099	<0.05	<0.0097	<0.0097	<0.0095	<0.01	<0.0099	<0.011	<0.011	<0.01	<0.01
Endosulfan sulfate	ND	ND	0/19	<0.0096	<0.0097	<0.0099	<0.0097	<0.0097	<0.0098	<0.0096	<0.01	<0.0099	<0.05	<0.0097	<0.0097	<0.0095	<0.01	<0.0099	<0.011	<0.011	<0.01	<0.01
Endrin	ND	ND	0/19	<0.0096	<0.0097	<0.0099	<0.0097	<0.0097	<0.0098	<0.0096	<0.01	<0.0099	<0.05	<0.0097	<0.0097	<0.0095	<0.01	<0.0099	<0.011	<0.011	<0.01	<0.01
Endrin aldehyde	ND	ND	0/19	<0.0096	<0.0097	<0.0099	<0.0097	<0.0097	<0.0098	<0.0096	<0.01	<0.0099	<0.05	<0.0097	<0.0097	<0.0095	<0.01	<0.0099	<0.011	<0.011	<0.01	<0.01
Endrin Ketone	ND	ND	0/19	<0.0096	<0.0097	<0.0099	<0.0097	<0.0097	<0.0098	<0.0096	<0.01	<0.0099	<0.05	<0.0097	<0.0097	<0.0095	<0.01	<0.0099	<0.011	<0.011	<0.01	<0.01
gamma-BHC (Lindane)	ND	ND	0/19	<0.0048	<0.0049	<0.005	<0.0049	<0.0049	<0.0049	<0.0048	<0.005	<0.005	<0.025	<0.0049	<0.0049	<0.0047	<0.005	<0.005	<0.011	<0.011	<0.01	<0.01
gamma-chlordane	ND	ND	0/19	<0.0048	<0.0049	<0.005	<0.0049	<0.0049	<0.0049	<0.0048	<0.005	<0.005	<0.025	<0.0049	<0.0049	<0.0047	<0.005	<0.005	<0.011	<0.011	<0.01	<0.01
Heptachlor	ND	ND	0/19	<0.0048	<0.0049	<0.005	<0.0049	<0.0049	<0.0049	<0.0048	<0.005	<0.005	<0.005	<0.0049	<0.0049	<0.0047	<0.005	<0.005	<0.011	<0.011	<0.01	<0.01
Heptachlor Epoxide	ND	ND	0/19	<0.0048	<0.0049	<0.005	<0.0049	<0.0049	<0.0049	<0.0048	<0.005	<0.005	<0.005	<0.0049	<0.0049	<0.0047	<0.005	<0.005	<0.011	<0.011	<0.01	<0.01
Methoxychlor	ND	ND	0/19	<0.048	<0.049	<0.05	<0.049	<0.049	<0.049	<0.048	<0.05	<0.05	<0.25	<0.049	<0.049	<0.047	<0.05	<0.05	<0.011	<0.011	<0.01	<0.01
SURR - 2,4,5,6-Tetrachloro-m-xylene	ND	ND	0/4																0.086	0.086	0.099	0.093
SURR - Decachlorobiphenyl	ND	ND	0/4																0.098	0.103	0.116	0.107
Technical Chlordane	ND	ND	0/4																<0.22	<0.22	<0.21	<0.21
Toxaphene	ND	ND	0/19	<0.096	<0.097	<0.099	<0.097	<0.097	<0.098	<0.096	<0.1	<0.099	<0.5	<0.099	<0.097	<0.095	<0.1	<0.099	<0.22	<0.22	<0.21	<0.21

TABLE B-10
Plow Shop Pond Invertebrate Data
Concentrations in mg/kg ww

			Mierzykowski and Carr (September 2000)						
			1998 Mussels (ug/g ww)						**1998 Crayfish (ug/g ww)**
Chemical	**Max (mg/kg)**	**Average (mg/kg)**	PLO-03A	PLO-03B	PLO-03C	PLO-06A	PLO-06B	PLO-06C	PLO-CY01
Aluminum	2.94	2.03	1.12	nd	nd	nd	nd	nd	2.94
Arsenic	2.45	1.03	0.71	0.66	0.4	0.79	0.93	0.83	1.62
Barium	95.1	62	84.8	80.5	95.1	55.9	51.3	32	37.7
Boron	0.47	0.41	0.4	0.35	0.47	nd	nd	nd	nd
Cadmium	0.62	0.23	0.39	0.24	0.34	0.34	0.36	0.19	0.11
Chromium	3.19	1.24	0.72	0.65	0.68	0.44	0.7	0.55	0.48
Copper	24.4	4.08	0.64	0.75	0.68	0.63	0.76	0.73	24.4
Iron	1372	779	1002	1103	1372	643	623	364	349
Lead	0.47	0.17	0.1	0.07	0.07	0.06	0.06	nd	0.28
Magnesium	388	141	110	119	89.5	81.1	96.7	104	388
Manganese	1042	672	1042	791	862	509	631	593	278
Mercury (Total)	0.069	0.04	0.0557	0.0481	0.0411	0.0434	0.0413	0.0427	0.0465
Methyl mercury	0.056	0.02	0.0264	0.0188	0.008	0.0073	0.0117	0.0071	0.0429
Nickel	0.27	0.15	0.11	nd	0.12	0.1	0.15	nd	0.27
Selenium	0.18	0.17	0.17	0.15	0.17	0.18	0.18	0.18	nd
Strontium	157	39	25.4	23.7	26.2	12.4	15.3	12	157
Zinc	23.3	19	21.7	21.8	17.8	14.6	17.3	18.6	23.3
% Moisture			85	86.7	87.3	84.5	85.2	84.9	

	Haines and Longcore (2001)															
	Cambarida								Corduliidae							
	North		Outlet		Red Cove		Roundhouse		North		Outlet		Red Cove		Roundhouse	
Chemical	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range
Arsenic	0.78	.71-.84	0.92	-	1.11	1.01-1.19	-	-	1.17	1.16-1.17	2.14	1.83-2.45	1.71	1.69-1.73	0.62	.52-.73
Cadmium	0.11	.1-.12	0.13	-	0.38	.15-.62	-	-	0.11	.09-.14	0.2	.19-.21	0.14	.13-.15	0.11	.09-.13
Chromium	2.16	1.62-2.7	2.42	-	2.23	1.21-3.06	-	-	2.54	1.89-3.19	1.59	1.11-2.07	1.23	.77-1.68	0.99	.65-1.32
Lead	0.16	0-.33	0.17	-	0.27	.16-.47	-	-	0.25	.24-.26	0.27	.25-.28	0.15	.14-.16	0.27	.26-.28
Mercury (Total)	0.035	.031-.038	0.056	-	0.046	.034-.059	-	-	0.037	.029-.046	0.066	.063-.069	0.041	.040-.042	0.023	.015-.031
Methyl mercury	0.026	.025-.028	0.025	-	0.039	.035-.042	-	-	0.029	.021-.037	0.054	.052-.056	0.029	.027-.032	0.023	.015-.030

Metrics for each sample also provided (length, width, breadth, weight, tissue weight)
All mussels were Eastern Elliptio (Elliptio complanata)

Sample sizes were not reported in Haines and Longcore (2001). Therefore, in cases where ranges are also not reported, there is no way to determine a maximum concentration at the location. The average concentrations are treated as composite samples in these circumstances and are considered maximum values.

TABLE B-11
Plow Shop Pond Invertebrate Data
Summary Stats by Taxonomic Group

Chemical	Mussels Max (mg/kg ww)	Mussels Average (mg/kg ww)[a]	Mussels FOD	Crayfish Max (mg/kg ww)	Crayfish Average (mg/kg ww)	Crayfish Sample Size[b]	Odonata Max (mg/kg ww)	Odonata Average (mg/kg ww)	Odonata Sample Size[c]
Aluminum	1.12	1.12	1/6	2.94	2.94	1	NA	NA	NA
Arsenic	0.93	0.72	6/6	1.62	1.11	4	2.5	1.4	4
Barium	95	67	6/6	38	38	1	NA	NA	NA
Boron	0.47	0.41	3/6	ND	ND	1	NA	NA	NA
Cadmium	0.39	0.31	6/6	0.62	0.18	4	0.21	0.14	4
Chromium	0.72	0.62	6/6	3.06	1.82	4	3.2	1.6	4
Copper	0.76	0.70	6/6	24	24	1	NA	NA	NA
Iron	1372	851	6/6	349	349	1	NA	NA	NA
Lead	0.1	0.07	5/6	0.47	0.22	4	0.28	0.24	4
Magnesium	119	100	6/6	388	388	1	NA	NA	NA
Manganese	1042	738	6/6	278	278	1	NA	NA	NA
Mercury (Total)	0.0557	0.05	6/6	0.06	0.05	4	0.069	0.042	4
Methyl mercury	0.0264	0.01	6/6	0.04	0.03	4	0.056	0.034	4
Nickel	0.15	0.12	4/6	0.27	0.27	1	NA	NA	NA
Selenium	0.18	0.17	6/6	ND	ND	1	NA	NA	NA
Strontium	26	19	6/6	157	157	1	NA	NA	NA
Zinc	22	19	6/6	23	23	1	NA	NA	NA

The information in this table was derived from the data presented in the previous table entitled Plow Shop Pond Invertebrate Data.

a. Average concentrations were not calculated using 1/2 the detection limit, as was done for other media, because detection limits were not available. Average concentrations were calculated using detected values only.

b. The frequency of detection (FOD) could not be determined for crayfish because sample sizes from Haines and Longcore (2001) are not available. Sample sizes of 1 are direct counts from the 1998 crayfish data. Sample sizes of 4 are based on the 1 sample from 1998 plus the 3 composite samples in Haines and Longcore (2001).

c. The frequency of detection (FOD) could not be determined for odonata because sample sizes from Haines and Longcore (2001) are not available. Sample sizes of 4 are based on the 4 composite samples in Haines and Longcore (2001).

TABLE B-12
Plow Shop Pond Frog Tissue Data
Concentration in mg/kg ww

			Sample Loc.	PLF01	PLF02	PLF03	PLF04	PLF05	PLF06	PLF07	PLF08	PLF09	PLF10	PLF11	PLF12	PLF13
			Date Sampled	7/28/1999	7/28/1999	7/29/1999	7/29/1999	7/29/1999	7/31/1999	8/3/1999	8/3/1999	8/3/1999	8/3/1999	8/3/1999	8/3/1999	8/3/1999
Name	**Max**	**average**														
aluminum	330	74.9		2.54	28	56.5	5U	5U	4.22	10.3	66.5	5U	5U	253	213	330
arsenic	0.705	0.26		0.12	0.461	0.242	0.167	0.152	0.196	0.145	0.26	0.0563	0.173	0.705	0.373	0.275
barium	19.7	7.25		9.92	7.5	4.26	11	9.83	2.42U	3.10U	3.73	1.59U	19.7	10.4	9.4	4.9
beryllium	nd	nd		0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U
boron	nd	nd		2.0U	2.0U	2.0U	2.0U	2.0U	2.0U	2.0U	2.0U	2.0U	2.0U	2.0U	2.0U	2.0U
cadmium	0.29	0.12		0.151	0.1U	0.1U	0.1U	0.12	0.1U	0.1U	.167J	0.1U	0.29	0.109	0.177	0.217
chromium	10.8	1.65		0.5U	0.696	0.591	0.313	.5U	.5U	0.63	1.32	0.5U	0.353	2.99	10.8	2.74
copper	5.29	2.64		3.82	2.95U	1.54U	4.09	3.07U	4.1	1.38U	3.89	1.46U	3.21	5.29	3.42	2.67U
iron	533	162		35.9	82.7	136	50.5	32.2	72.6	51.7	107	40	32.7	533	490	446
lead	1.09	0.44		0.587	0.152U	.202U	.116U	0.381U	0.829	.137U	0.461	0.179U	0.62	0.594	0.914	1.09
magnesium	427	269		204	244	232	229	206	255	234	323	217	304	302	321	427
manganese	47.5	16.8		9.11	3.55	13.5	2.8	9.16	3.66	23.6	47.5	5.21	17.7	18.5	29	34.7
total mercury	0.201	0.062		0.0533	0.0265	0.0508	0.0305	0.0475	0.0724	0.0896	0.201	0.0286	0.0438	0.0367	0.0415	0.085
MeHg	0.224	0.064		0.0541	0.0106	0.0542	0.007	0.0508	0.0761	0.105	0.224	0.0262	0.0437	0.0447	0.0347	0.0972
molybdenum	nd	nd		2.0U	2.0U	2.0U	2.0U	2.0U	2.0U	2.0U	2.0U	2.0U	2.0U	2.0U	2.0U	2.0U
nickel	5.02	0.90		0.5U	0.363	0.407	0.782	.5U	.5U	0.309	0.439	0.5U	0.21	2.12	5.02	1.01
selenium	0.797	0.39		0.653	0.261	0.355	0.272	0.612	0.492	0.158	0.208	0.196	0.797	0.496	0.428	0.146
strontium	13	9.60		8.94	6.84	10.9	9.35	7.78	10.4	10.5	13	7.89	11.8	7.3	10.3	9.78
vanadium	0.693	0.33		0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.628	0.517	0.693
zinc	97.2	31.8		43.6	17	27.4	12.2	47.4	14.7	12.6	19.8	13.7	97.2	43.9	42.7	21.6

Source:
EPA (2001)

TABLE B-13
Plow Shop Ponf Tree Swallow Egg Data
Concentrations in mg/kg ww

			Plow Shop Pond Eggs 1998 (mg/kg)					Plow Shop Pond Eggs 1999 (mg/kg)				
Chemical	**Max**	**Average**	Mean	n (det)	n (ND)	range	1/2 Max DL	Mean	n (det)	n (ND)	range	1/2 Max DL
Mercury	1.059	0.615	0.786	4	0	0.636-1.059		0.539	9	0	0.299-0.945	
Arsenic	0.58	0.191	0.58	1	3	na	0.2	BD	0	9	BD	0.145
Cadmium	ND	ND	BD	0	4	BD	0.2	BD	0	9	BD	0.0035
Chromium	0.47	0.217	0.44	3	1	0.41-0.47	0.2	BD	0	9	BD	0.145
Lead	0.47	0.204	BD	0	4	BD	0.2	0.419	2	7	0.37-0.47	0.145

NA indicates no samples analyzed
BD indicates delow detection

Haines, T.A. and J.R. Longcore. 2001. Final Report, Bioavailability and Potential Effects of Mercury and Selected Other Trace Metals on Biota in

TABLE B-14
Plow Shop Pond Tree Swallow Stomach Content Data
Concentrations in mg/kg ww

			Plow Shop Pond Food Boli 1998 (mg/kg)				Plow Shop Pond Food Boli 1999 (mg/kg)				
Chemical	**Max**	**Average**	Mean	n	range	% < LOD (range)	Mean	n	n(ND)	range	1/2 max DL
Mercury	0.211	0.195	NA	NA	NA	NA	0.195	3	0	0.187-0.211	
Arsenic	<.82	BD	NA	NA	NA	NA	0	0	3	BD	0.41
Cadmium	2.99	1.43	NA	NA	NA	NA	1.43	3	0	0.56-2.99	-
Chromium	189	117	NA	NA	NA	NA	117	3	0	56-189	-
Lead	1.57	1.25	NA	NA	NA	NA	1.25	3	0	0.79-1.57	-

NA indicates no samples analyzed

Source:

Haines, T.A. and J.R. Longcore. 2001. Final Report, Bioavailability and Potential Effects of Mercury and Selected Other Trace Metals on Biota in Plow Shop and Grove Ponds, Fort Devens, Massachusetts. USGS Report to the EPA. April 2001.

Appendix C
Data Summary Tables for Flannagan Pond

TABLE C-1
Surface Water from Flannagan Pond

Sample Name	Flan-SW-1	
Laboratory Sample ID	56324	
Sampling date	11/3/2004	
Total Recoverable Metals (ug/l)		
Aluminum	720	J
Antimony	0.5	ND
Arsenic	5	
Barium	17	
Beryllium	0.2	ND
Cadmium	0.2	ND
Calcium	7,100	
Chromium	2	J
Cobalt	0.72	
Copper	3	J
Iron	1800	
Lead	3.5	
Magnesium	1,300	
Manganese	310	
Mercury (total)	0.5	ND
Molybdenum	0.5	ND
Nickel	1.8	
Selenium	1	ND
Silver	0.2	ND
Thallium	0.5	ND
Vanadium	1.3	
Zinc	13	J
Dissolved Metals (ug/l)		
Aluminum	5	ND
Antimony	0.5	ND
Arsenic	0.58	
Barium	7.6	
Beryllium	0.2	ND
Cadmium	0.2	ND
Calcium	6,500	
Chromium	0.5	ND
Cobalt	0.55	
Copper	1	
Iron	50	ND
Lead	0.2	ND
Magnesium	1,100	
Manganese	6.9	
Total Mercury in Water	0.5	ND
Molybdenum	0.5	ND
Nickel	0.51	
Selenium	1	ND
Silver	0.2	ND
Thallium	0.5	ND
Vanadium	0.2	ND
Zinc	5	ND

TABLE C-1
Surface Water from Flannagan Pond

Sample Name	**Flan-SW-1**	
Laboratory Sample ID	56324	
Sampling date	11/3/2004	
Pesticides (ug/l)		
4,4'-DDD	0.030	ND
4,4'-DDE	0.030	ND
4,4'-DDT	0.034	ND
Aldrin	0.060	ND
Alpha Chlordane	0.030	ND
Alpha-BHC	0.030	ND
Beta-BHC	0.030	ND
Delta-BHC	0.030	ND
Dieldrin	0.030	ND
Endosulfan I	0.030	ND
Endosulfan II	0.030	ND
Endosulfan Sulfate	0.030	ND
Endrin	0.030	ND
Endrin Aldehyde	0.030	ND
Endrin Ketone	0.030	ND
Gamma Chlordane	0.030	ND
Gamma-BHC	0.030	ND
Heptachlor	0.034	ND
Heptachlor Epoxide	0.030	ND
Methoxychlor	0.030	ND
Technical Chlordane	0.600	ND
Toxaphene	0.600	ND
Polychlorinated biphenyls (ug/l)		
Aroclor-1016	0.600	ND
Aroclor-1221	0.600	ND
Aroclor-1232	0.600	ND
Aroclor-1242	0.600	ND
Aroclor-1248	0.600	ND
Aroclor-1254	0.600	ND
Aroclor-1260	0.600	ND
Aroclor-1262	0.600	ND
Aroclor-1268	0.600	ND
ND = non detected		
ND values represent reporting limits		

TABLE C-2
Sedoment Data from Flannagan Pond

Sample Name	Average	Flan-Sed-1		FP01	
Sampling Date		2/2/2005		3/3/2004	
Polycyclic Aromatic Hydrocarbons (ug/kg, dry weight)					
Acenaphthene		41		NA	
Acenaphthylene		170		NA	
Anthracene		250		NA	
Benzo(a)anthracene		680		NA	
Benzo(a)pyrene		850		NA	
Benzo(b) fluoranthene		1500		NA	
Benzo(g,h,i) perylene		930		NA	
Benzo(k)fluoranthene		500		NA	
Chrysene		1100		NA	
Dibenzo(a,h) anthracene		190		NA	
Fluoranthene		2200		NA	
Fluorene		200		NA	
Indeno(1,2,3-cd) pyrene		780		NA	
Naphthalene		140		NA	
Phenanthrene		1100		NA	
Pyrene		1700		NA	
Total PAHs		12331		NA	
Pesticides (ug/kg, dry weight)				NA	
4,4'-DDD		50		NA	
4,4'-DDE		170		NA	
4,4'-DDT		7.2	J	NA	
aldrin		7.6	ND	NA	
alpha-chlordane		7.6	ND	NA	
alpha-BHC		7.6	ND	NA	
beta-BHC		7.6	ND	NA	
delta-BHC		7.6	ND	NA	
dieldrin		7.6	ND	NA	
endosulfan I		7.6	ND	NA	
endosulfan II		7.6	ND	NA	
endosulfan sulfate		7.6	ND	NA	
endrin		7.6	ND	NA	
Endrin Aldehyde		7.6	ND	NA	
Endrin Ketone		7.6	ND	NA	
Gamma Chlordane		7.6	ND	NA	
Gamma-BHC		7.6	ND	NA	
Heptachlor		7.6	ND	NA	
Heptachlor Epoxide		7.6	ND	NA	
Methoxychlor		7.6	ND	NA	
Technical Chlordane		160	ND	NA	
Toxaphene		160	ND	NA	
Aroclors (ug/kg, dry weight)				NA	
Aroclor-1016		160	ND	NA	
Aroclor-1221		160	ND	NA	
Aroclor-1232		160	ND	NA	
Aroclor-1242		160	ND	NA	
Aroclor-1248		160	ND	NA	
Aroclor-1254		160	ND	NA	
Aroclor-1260		160	ND	NA	
Aroclor-1262		160	ND	NA	
Aroclor-1268		160	ND	NA	
Metals (mg/kg, dry weight)				NA	
Aluminum	7100	**7800**		6400	
Antimony	ND	28	ND	10	ND
Arsenic	82.5	**110**	J	55	
Barium	82.5	73	J	**92**	
Beryllium	1.25	2.8	ND	**1.1**	
Cadmium	12	11		**13**	
Calcium	6350	5700		**7000**	
Chromium	17.5	**21**		14	
Cobalt	11	**12**		10	
Copper	32	**36**		28	
Iron	12500	**13000**		12000	
Lead	160	**200**	J	120	
Magnesium	1150	**1200**		1100	
Manganese	575	460		**690**	
Mercury (total)	0.3	0.3		**0.3**	
Nickel	23	**26**	J	20	
Potassium	600	**700**		1000	ND
Selenium	ND	56	ND	10	ND
Silver	ND	8.3	ND	3	ND
Sodium	ND	1400	ND	1000	ND
Thallium	ND	56	ND	20	ND
Vanadium	30	**39**		21	
Zinc	245	**280**		210	
Simultaneously-Extracted Metals (umole/g)					
Antimony		0.309	ND	NA	
Cadmium		0.089		NA	
Chromium		0.224		NA	
Copper		0.628		NA	
Lead		0.882		NA	
Mercury		0.00187		NA	
Nickel		0.256	ND	NA	
Zinc		4.26		NA	
Acid Volatile Sulfides (umole/g)					
		11.3			
Total Organic Carbon (mg/kg dry weight)					
		280000	J		
Maximum concentration in bold.					

TABLE C-3
Fish Data from Flannagan Pond

Sample Name	Maximum	Average	Flan-BGSF-WB		Flan-BLCR-WB		Flan-Pick-WB	
Laboratory Sample ID	Maximum	Average	56587		56588		56589	
Sampling Date	Concentration	Concentration	6/30/2004		6/30/2004		6/30/2004	
Metals (mg/kg)								
Aluminum	7.8	3.80	7.8		1.6	ND	2.8	
Antimony	ND	ND	0.8	ND	0.78	ND	0.8	ND
Arsenic	ND	ND	1.6	ND	1.6	ND	1.6	ND
Barium	3.5	2.24	3.5		2.7		0.52	
Beryllium	ND	ND	0.08	ND	0.078	ND	0.08	ND
Cadmium	ND	ND	0.24	ND	0.23	ND	0.24	ND
Calcium	1.6	1.6	1.6	S	1.6	S	1.6	S
Chromium	0.84	0.75	0.58		0.84		0.82	
Cobalt	ND	ND	0.24	ND	0.23	ND	0.24	ND
Copper	0.51	0.43	0.51		0.31		0.48	
Iron	52	25.10	52		14		9.3	
Lead	ND	ND	1.6	ND	1.6	ND	1.6	ND
Magnesium	640	543.33	540		640		450	
Manganese	37	22.00	37		14		15	
Mercury in Tissue	0.3	0.19	0.06		0.3		0.2	
Nickel	ND	ND	0.48	ND	0.47	ND	0.48	ND
Potassium	3700	3366.67	3300		3100		3700	
Selenium	ND	ND	0.8	ND	0.78	ND	0.8	ND
Silver	ND	ND	0.24	ND	0.23	ND	0.24	ND
Sodium	1400	1233.33	1300		1400		1000	
Thallium	ND	ND	1.6	ND	1.6	ND	1.6	ND
Vanadium	ND	ND	0.24	ND	0.23	ND	0.24	ND
Zinc	56	34.33	25		22		56	
Pesticides/PCBs (ug/kg)								
4,4'-DDD	33	24.67	14		27		33	
4,4'-DDE	280	162.67	88		120		280	
4,4'-DDT	ND	ND	10	ND	10	ND	11	ND
Aldrin	ND	ND	10	ND	10	ND	11	ND
Alpha Chlordane	ND	ND	10	ND	10	ND	11	ND
Alpha-BHC	ND	ND	10	ND	10	ND	11	ND
Aroclor-1016	ND	ND	210	ND	210	ND	220	ND
Aroclor-1221	ND	ND	210	ND	210	ND	220	ND
Aroclor-1232	ND	ND	210	ND	210	ND	220	ND
Aroclor-1242	ND	ND	210	ND	210	ND	220	ND
Aroclor-1248	ND	ND	210	ND	210	ND	220	ND
Aroclor-1254	ND	ND	210	ND	210	ND	220	ND
Aroclor-1260	ND	ND	210	ND	210	ND	220	ND
Aroclor-1262	ND	ND	210	ND	210	ND	220	ND
Aroclor-1268	ND	ND	210	ND	210	ND	220	ND
Beta-BHC	ND	ND	10	ND	10	ND	11	ND
Delta-BHC	ND	ND	10	ND	10	ND	11	ND
Dieldrin	ND	ND	10	ND	10	ND	11	ND
Endosulfan I	ND	ND	10	ND	10	ND	11	ND
Endosulfan II	ND	ND	10	ND	10	ND	11	ND
Endosulfan Sulfate	ND	ND	10	ND	10	ND	11	ND
Endrin	ND	ND	10	ND	10	ND	11	ND
Endrin Aldehyde	ND	ND	10	ND	10	ND	11	ND
Endrin Ketone	ND	ND	10	ND	10	ND	11	ND
Gamma Chlordane	ND	ND	10	ND	10	ND	11	ND
Gamma-BHC	ND	ND	10	ND	10	ND	11	ND
Heptachlor	ND	ND	10	ND	10	ND	11	ND
Heptachlor Epoxide	ND	ND	10	ND	10	ND	11	ND
Methoxychlor	ND	ND	10	ND	10	ND	11	ND
Technical Chlordane	ND	ND	210	ND	210	ND	220	ND
Toxaphene	ND	ND	210	ND	210	ND	220	ND

Appendix D
Toxicity Test Reports for Grove Pond, Plow Shop Pond, and Flannagan Pond

LOCKHEED MARTIN

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Environmental Services Assistance Team, Region I
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Phone: 978-275-9730 Fax: 978-275-9489

May 13, 2005

Office of Environmental Measurement and Evaluation
US EPA - Region I
11 Technology Drive
North Chelmsford, MA 01863

To: Mr. Bart Hoskins, EPA TOPO
Via: Mr. Louis Macri, ESAT Team Manager

TDF No. 1440 I
Task Order No. 21
Task No. 5

Subject: Fort Devens Superfund Site Surface Water Toxicity Testing Report

Dear Mr. Hoskins:

Environmental Services Assistance Team (ESAT) members completed toxicity testing using surface water samples collected from six locations in Plow Shop Pond and six locations in Grove Pond in the vicinity of the Fort Devens Superfund Site in Ayer, Massachusetts. One background surface water sample was obtained from Flannagan Pond, upstream from the site. The task was requested by Bart Hoskins, the Task Order Project Officer (TOPO), under TDF 1440H.

This task included a two species chronic test as well as a concurrent two species chronic reference toxicity test using a freshwater cladoceran (*Ceriodaphnia dubia)* and the fathead minnow *(Pimephales promelas).* Both tests were performed according to methods described in *Short-Term Methods For Estimating The Chronic Toxicity Of Effluents and Receiving Waters To Freshwater Organisms*, 3rd edition, EPA/600/4-91/002, July 1994.

Sediment toxicity tests were also performed under this TDF on samples collected from Grove, Plow Shop, and Flannagan Ponds in February of 2005. The report for these tests will be submitted separately.

Should you have any questions or comments, please contact Rayann Richard of ESAT-Lockheed Martin at (617)-918-8648 or Melissa Grable of ESAT-Lockheed Martin at (617) 918-8681 at the EPA/OEME Biology Section, North Chelmsford, MA.

Sincerely,

Lockheed Martin Information Technologies

Rayann Richard
Environmental Scientist

TOXICITY TESTING RESULTS USING SURFACE WATER SAMPLES FROM GROVE, PLOW SHOP AND FLANNAGAN PONDS
FORT DEVENS SUPERFUND SITE
AYER, MASSACHUSETTS

Submitted to the:

Office of Environmental Measurement and Evaluation
United States Environmental Protection Agency - Region I
11 Technology Drive
North Chelmsford, Massachusetts 01863

ESAT - Region I
Lockheed Martin Information Technologies
The Wannalancit Mills, 175 Cabot Street, Suite 415
Lowell, Massachusetts 01854

TDF No. 1440 I
Task Order No. 21
Task No. 5

May 13, 2005

Table of Contents

1.0 INTRODUCTION

This report describes the results of chronic toxicity tests performed on surface water samples collected from six locations on Grove Pond (G1-G6) and six locations on Plow Shop Pond (PS1-PS6). Both ponds are associated with the Fort Devens Superfund Site in Ayer, Massachusetts. Grove Pond has been impacted by a former tannery, whereas Plow Shop Pond has been impacted by the closed Shepley's Hill Landfill and a former railroad roundhouse (see **Appendix A**). An additional single surface water sample was taken from a reference pond (Flannagan Pond) located in Ayer, Massachusetts, upgradient from Grove Pond (see **Appendix A**). Sufficient sample volumes were collected to renew the test water over the 7-day exposure period. These aquatic toxicity tests were performed to evaluate the potential impact on water column organisms resulting from contamination originating from the closed landfill, former railroad roundhouse, and former tannery.

All surface water samples were collected from Plow Shop Pond, Grove Pond and Flannagan Pond on November 3, 2004 by EPA with support from ESAT (see **Appendix A** for sample locations and **Appendix G** for sample-specific latitudes and longitudes). All surface water samples were collected and delivered to the EPA Office of Ecosystem Management and Evaluation (OEME) facility in North Chelmsford, Massachusetts, on November 3, 2004 and held in a sample refrigerator at 4°C until test initiation. For each location, a separate surface water sample was submitted to the OEME chemistry laboratory for chemical analysis. These samples were analyzed for total recoverable metals, dissolved metals, pesticides, and polychlorinated biphenyls (PCBs). The surface water analytical data are provided in **Appendix F**.

Chronic toxicity tests were performed using two sensitive aquatic species, namely the freshwater cladoceran, *Ceriodaphnia dubia*, and the fathead minnow, *Pimephales promelas.*

These test organisms are routinely used for toxicity testing at the EPA/OEME, Biology Section Laboratory. The *C. dubia* are cultured in-house, and the *P. promelas* were obtained from the U.S. EPA Newtown, Ohio facility. Both species are monitored for quality through an on-going reference toxicity testing program.

2.0 STUDY OBJECTIVES

Previous investigations have indicated the presence of trace metals such as barium, iron and manganese (USEPA, 1999) in the surface water of the two target ponds. The purpose of this study was to determine if survival (*C. dubia* and *P. promelas*), growth (*P. promelas*), or reproduction (*C. dubia*) of the test organisms exposed to site surface water differed significantly from the background surface water sample collected from Flannagan Pond, located upstream from Grove Pond. The laboratory control sample was only used to verify that the organisms were healthy and that the test passed test acceptability criteria (TAC) specified in EPA (1994). The response data were statistically analyzed to determine if these endpoints were significantly different in the Site samples when compared to the background sample.

3.0 MATERIALS AND METHODS

3.1 Sample Collection

Surface water samples were collected from Grove Pond, Plow Shop Pond, Flannagan Pond (background) by EPA with support from ESAT on November 3, 2004. The sample containers were 20-liter plastic Cubitainers. At each sample location, two Cubitainers were filled with surface water. The Cubitainers were placed on ice and kept in coolers until delivered that day to the OEME facility in North Chelmsford, Massachusetts. Samples were held at 4°C until test initiation. The test was started on November 4, 2004 and ended on November 12, 2004. Chain-of-custody records are included in **Appendix B**.

3.2 Toxicity Test Methods

The toxicity tests were performed according to procedures detailed in the EPA OEME Biology Section Standard Operating Procedure (SOP) Number 2.7, which describes aquatic toxicity test methods used by the EPA/OEME according to EPA (1994).

3.2.1 *C. dubia* Test Method

The surface water samples were tested at full strength (100% undiluted). Synthetic 60 mg/L $CaCO_3$ hardness water was used as the laboratory control water for the *C. dubia*. The synthetic water was also used to culture the *C.dubia.* The 60 mg $CaCO_3$/liter hardness process water consisted of a mixture of well water from the North Chelmsford Laboratory and distilled deionized water, ammended with sodium bicarbonate. This water was used as the laboratory control water for the *P. promelas.* The surface water sample hardness ranged from approximately 40-80 mg $CaCO_3$/L for Grove Pond, 32-38 mg $CaCO_3$/L for Plow Shop Pond and 20 mg $CaCO_3$/L for Flannagan Pond.

Ten replicates of each surface water sample (on-site and background) and the laboratory control were prepared to start the test. The background sample was split and tested in parallel with the Plow Shop Pond samples and the Grove Pond samples. Each culture tube was rinsed with 60 mg $CaCO_3$/L hardness synthetic water prior to use. Each replicate consisted of 15 ml sample added to a 20 ml culture tube. Test tubes were randomized in racks before adding the test organisms to eliminate bias in introduction, feeding, or environmental factors such as light and temperature variations. One *C. dubia* neonate (less than 24 hours old) was placed into each tube. Throughout the test, all the organisms were fed 100 μl of a yeast, alfalfa, trout chow (YAT) mixture and 100 μl of *Selenastrum capricornutum* daily.

Daily test maintenance consisted of filling and randomizing a new rack of culture tubes with ten replicates of each sample and the control, placing the freshly filled tubes into the environmental chambers to allow the water in the tubes to warm to 25°C. Food was added to each tube just prior to moving each organism to the new tube. This daily renewal took place for eight days. The test was run in an environmental chamber at 25 $\pm$ 1°C in a 16:8 hour light:dark cycle. Every 24 hours, observations on brooder mortality and reproduction were recorded, initialed, and dated on laboratory data sheets. Feedings were also recorded and initialed in a laboratory notebook. All the test renewals were performed with pond water collected on November 4, 2004. The test was ended on day 8. Copies of the laboratory bench sheets are provided in **Appendix D**.

3.2.2 *P. promelas* Test Method

The *P. promelas* test was initiated with four replicates, each consisting of 250 ml of (100% undiluted) sample in a 300 ml beaker. Each replicate contained ten *P. promelas* neonates (less than 24 hours old). The fish were placed into the beakers, which were randomized on a laboratory cart and placed in an environmental chamber at 25 $\pm$ 1°C in a 16:8 hour light:dark cycle. Mortalities were recorded every 24 hours and initialed and dated on standard laboratory bench sheets. The fish were fed 150 μl of a concentrated suspension of live *Artemia* (brine shrimp) before and after each daily renewal.

Daily renewals for the *P. promelas* test consisted of removing dead *Artemia* and any dead *P. promelas*. Approximately 200 mls of sample in each replicate were then removed, and replaced with fresh sample. The renewal schedule for the *P. promelas* was the same as for the *C. dubia*. The test was ended on day 7. Feedings occurred pre- and post-renewal, and were recorded and initialed and dated in a laboratory logbook. At the end of the test, the surviving organisms were placed in pre-weighed aluminum weigh pans and dried for at least 24 hours at 60°C. The mean dry biomass per replicate for each surface water location was determined for the growth endpoint. The mean dry weight was also determined since the test acceptability criteria (TAC) is based on mean dry weight. Copies of the laboratory data sheets can be found in **Appendix D**.

For both the *C. dubia* and the *P. promelas* tests, initial chemistry consisting of pH, conductivity, dissolved oxygen (DO), temperature, alkalinity, and hardness, was performed on each sample at the start of the test. Routine chemistry (pH, conductivity, DO, and temperature) was performed on daily renewal waste water in order to identify changes which could have affected the test outcome. Test chemistry is summarized in **Appendix C**.

3.3 Statistical Analyses

Statistical analyses for both tests were conducted using CETIS ® (Comprehensive Environmental Toxicity Information System) according to the EPA decision tree in EPA (1994). Survival data and reproduction or growth data were analyzed separately.

Data were first analyzed using the Bartlett's test and Modified Levene's test to check for homogeneity of variance, and Shapiro-Wilk's and Kolmogorov-Smirnov tests to check for normality. Data with normal distribution and homogeneous variance were analyzed using Dunnett's Multiple Comparison Test. Non-normal or heterogeneous data were analyzed using Steel's Many-One Rank Test.

Both Steel's Many-One Rank Test and Dunnett's Multiple Comparison Test were used to determine if a significant difference existed between the background and the Plow Shop Pond and Grove Pond samples. Fisher's Exact Test was used to analyze the *C. dubia* survival data. Fisher's Exact Test was also used to determine if a significant difference existed between the background and the Plow Shop Pond and Grove Pond samples. The CETIS ® statistical print-outs are provided in **Appendix D**.

4.0 RESULTS

4.1 *C. dubia* Survival and Reproduction

The endpoints measured for *C.dubia* were survival and reproduction after 8 days of exposure. The survival data for Grove Pond (G1 to G6) and Plow Shop Pond (PS1 to PS 6) are presented in **Tables 1** and **2**, respectively (F1=Flannagan Pond).

Table 1: *C. dubia* 8-day Survival - Grove Pond							
Lab Control	**F1**	**G1**	**G2**	**G3**	**G4**	**G5**	**G6**
Percent Survival							
100%	100%	100%	70%	100%	80%	100%	90%

The *C. dubia* toxicity test met test acceptability criteria (TAC) with 100% control survival, which is above the minimum acceptable of 80%. The *C. dubia* survival results were evaluated using Fisher's Exact Test to determine if there was a significant difference ($p \leq 0.05$) in survival between the background sample and the Grove Pond samples. No such differences were found.

Table 2: *C. dubia* 8-day Survival - Plow Shop Pond							
Lab Control	**F1**	**PS1**	**PS2**	**PS3**	**PS4**	**PS5**	**PS6**
Percent Survival							
60%	100%	90%	90%	100%	80%	90%	100%

The *C. dubia* toxicity test for Plow Shop Pond did not meet TAC since there was only 60% control survival instead of the minimum acceptable 80%. However, according to EPA, this test was conditionally acceptable due to the high survival rates in the background sample (F1) and in all of the pond samples.

The *C. dubia* survival results for Plow Shop Pond were evaluated using Fisher's Exact Test to determine whether there was a significant difference ($p \leq 0.05$) in survival between the background sample and the Plow Shop samples. No such differences were found.

The reproduction data for Grove Pond and Plow Shop Pond are presented in **Tables 3** and **4**, respectively.

Table 3: *C. dubia* Reproduction - Grove Pond								
Station	**Lab Control**	**F1**	**G1**	**G2**	**G3**	**G4**	**G5**	**G6**
Neonate Production								
Avg # of neonates per surviving brooder	37	44	45	45	49	49	41	46

Table 3: *C. dubia* Reproduction - Grove Pond								
Station	**Lab Control**	**F1**	**G1**	**G2**	**G3**	**G4**	**G5**	**G6**
Neonate Production								
% of brooders with 3+ broods**	100%	100%	90%	70%	100%	80%	100%	90%
Avg # of neonates for brooders with 3+ broods**	37	44	50	45	49	49	41	46

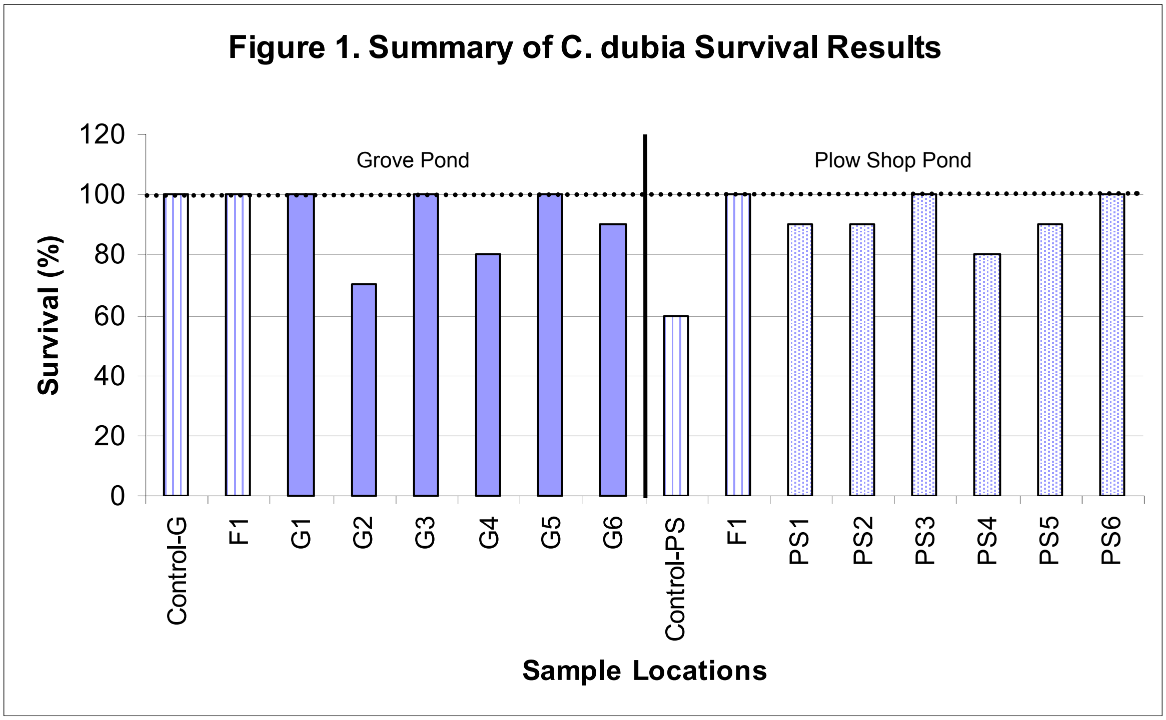
** - Excludes neonates from dead brooders

Table 4: *C. dubia* Reproduction - Plow Shop Pond								
Station	**Lab Control**	**F1**	**PS1**	**PS2**	**PS3**	**PS4**	**PS5**	**PS6**
Neonate Production								
Avg # of neonates per surviving brooder	36	42	53	45	50	38	40	47
% of brooders with 3+ broods**	60%	90%	90%	90%	100%	70%	80%	100%
Avg # of neonates for brooders with 3+ broods**	36	46	53	45	50	42	44	47

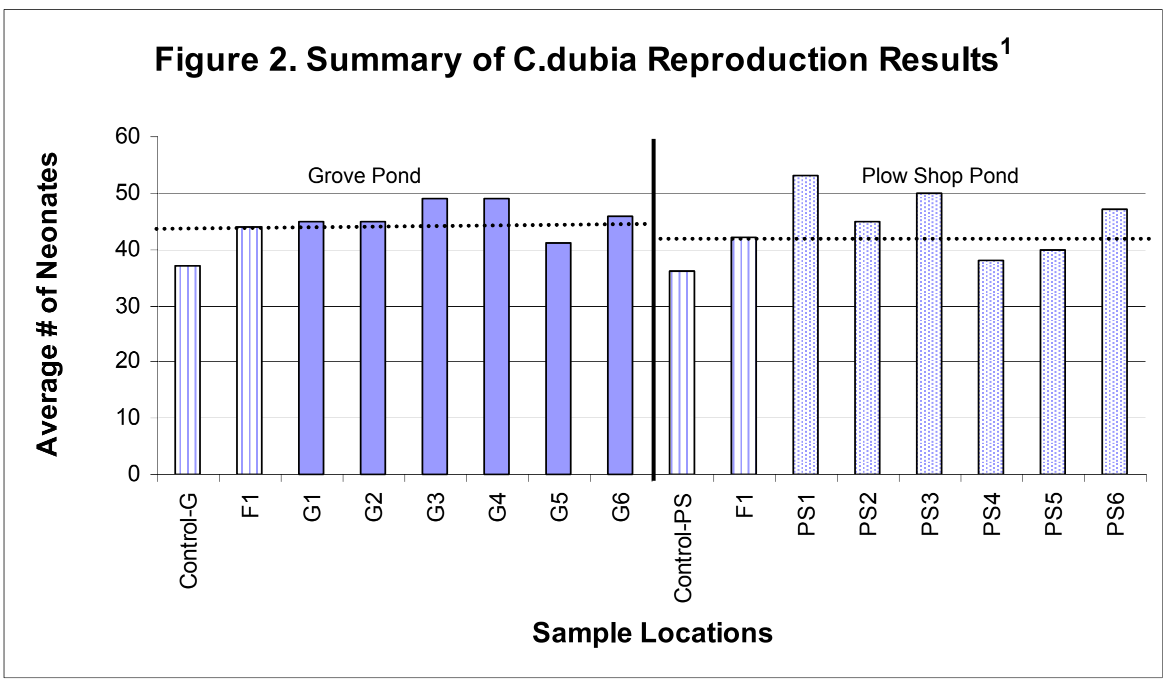
** - Excludes neonates from dead brooders

Both laboratory controls met the reproduction TAC specified in EPA (1994). The TAC states that 60% of the surviving brooders in the controls must have had at least three broods, with an average total number of 15 or more neonates per surviving brooder. All ten organisms in the laboratory control for Grove Pond had three or more broods with an average total number of 37 neonates per surviving brooder. Six of the ten organisms in the laboratory control for Plow Shop Pond had three or more broods with an average total number of 36 neonates per surviving brooder. All ten organisms in the background sample associated with the Grove Pond test had three or more broods with an average total number of 44 neonates per brooder. Nine of the ten organisms in the background sample for the Plow Shop Pond test had three or more broods with an average total number of 46 neonates per brooder. The number of surviving brooders with three or more broods in the Grove Pond samples ranged from 7 to 10 and the average number of neonates produced in 3+ broods ranged from 41 to 50. The number of brooders with three or more broods in the Plow Shop samples ranged from 7 to 10 and the average number of neonates produced in 3+ broods ranged from 42 to 53.

The *C. dubia* reproduction results were evaluated using Dunnett's Multiple Comparison (Grove Pond) and Steel's Many-One Rank Test (Plow Shop Pond) to determine whether there was a statistically significant (p=0.05) difference in reproduction between the background sample and the Plow Shop Pond or Grove Pond samples. **Figures 1** and **2** below indicated that when samples from Grove Pond and Plow Shop Pond were compared to the background, no significant differences were found.



.... Background sample reference line (F1)
PS – Plow Shop Pond
G – Grove Pond



1 – Average # of neonates per surviving brooder
.... Background sample reference line (F1)
PS – Plow Shop Pond
G – Grove Pond

4.2 *P. promelas* Survival and Growth

The endpoints for the *P. promelas* test were survival and growth. The test data were evaluated to determine if percent survival and mean organism biomass at the end of the test differed significantly between the Plow Shop Pond (PS1 to PS 6) and Grove Pond (G1 to G6) samples when compared to the background sample from Flannagan Pond (F1). The *P. promelas* survival and growth data were summarized in the following tables.

The *P. promelas* survival data are presented in **Tables 5** and **6** below.

Table 5: *P. promelas* 7-day Survival - Grove Pond							
Lab Control	**F1**	**G1**	**G2**	**G3**	**G4**	**G5**	**G6**
Percent Survival							
95%	97.5%	92.5%	97.5%	97.5%	100%	95%	100%

Table 6: Surface Water Toxicity Test: *P. promelas* 7-day Survival – Plow Shop Pond							
Lab Control	**F1**	**PS1**	**PS2**	**PS3**	**PS4**	**PS5**	**PS6**
Percent Survival							
95%	97.5%	95%	100%	97.5%	95%	100%	95%

The P. promelas test met the survival threshold of 80% for the laboratory control survival as specified in EPA (1994). The survival data were evaluated using Dunnett's Multiple Comparison Test to determine if there was a significant ($p \leq 0.05$) difference in survival between the pond samples and laboratory control or betweens the pond samples and the background sample. No significant differences were found.

The *P. promelas* growth data are presented in **Table 7** and **8** below.

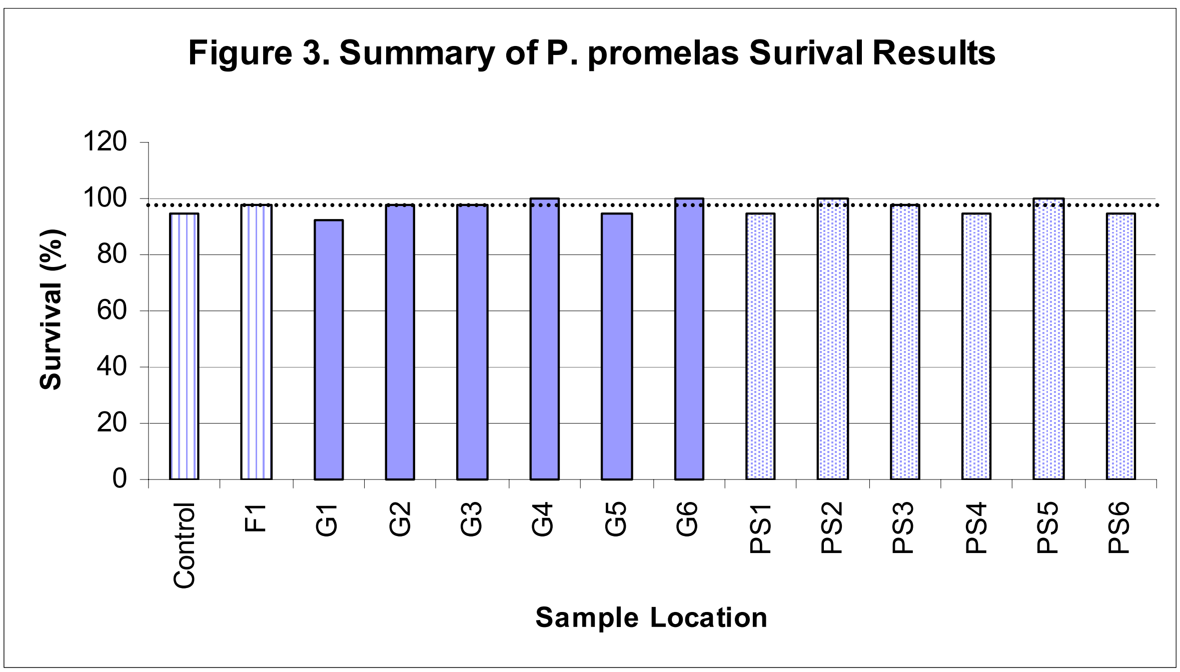
Table 7: *P. promelas* Average Dry Biomass and Average Dry Weight (mg) for Grove Pond								
	Lab Control	**F1**	**G1**	**G2**	**G3**	**G4**	**G5**	**G6**
Average Dry Biomass [a]	0.50	0.57	0.51	0.55	0.56	0.50	0.51	0.53
Average Dry Weight [b]	0.53	0.59	0.55	0.57	0.58	0.50	0.53	0.53

[a] Average dry biomass = measured dry weight ÷ number of exposed organisms
[b] Average dry weight = measured dry weight ÷ number of surviving organisms

Table 8: *P. promelas* Average Dry Biomass and Average Dry Weight (mg) for Plow Shop Pond								
	Lab Control	**F1**	**PS1**	**PS2**	**PS3**	**PS4**	**PS5**	**PS6**
Average Dry Biomass [a]	0.50	0.57	0.49	0.58	0.55	0.53	0.55	0.56
Average Dry Weight [b]	0.53	0.59	0.51	0.58	0.56	0.56	0.55	0.59

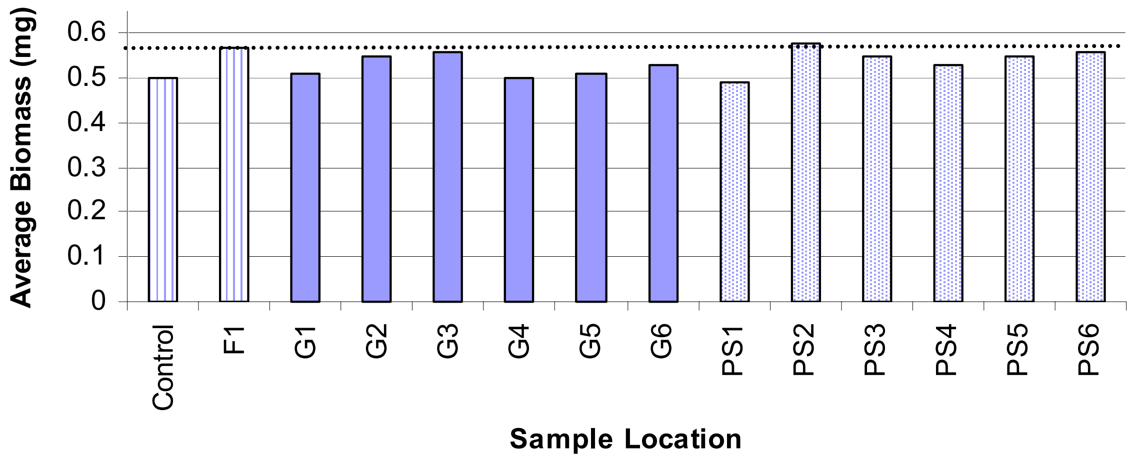
[a] Average dry biomass = measured dry weight ÷ number of exposed organisms
[b] Average dry weight = measured dry weight ÷ number of surviving organisms

EPA (1994) includes, as a test acceptability criterion, an average dry weight per surviving control larvae equal to or exceeding 0.25 milligrams. This criterion was met by all sampling locations. The biomass data were evaluated using Dunnett's Multiple Comparison Test to determine whether growth in the Grove and Plow Shop Pond samples were significantly different when compared with the background sample. No significant differences were found. The results of the comparisons are summarized in **Figures 3** and **4** below.



············ Background sample reference line (F1)
PS – Plow Shop Pond
G – Grove Pond

Figure 4. Summary of P. promelas Average Dry Biomass per Organism Results



·········· Background sample reference line (F1)
PS – Plow Shop Pond
G – Grove Pond

5.0 DISCUSSION AND CONCLUSION

5.1 *C. dubia*

The *C. dubia* toxicity test met test the TAC for the Grove Pond control with 100% control survival but did not meet the TAC for the Plow Shop Pond control which had 60% control survival instead of the minimum acceptable 80% control survival. According to EPA, the Plow Shop Pond test was conditionally acceptable due to the high survival rates in the background (100%) and pond samples (80%-100%). A Fisher's Exact Test showed no significant differences in survival between the Plow Shop Pond samples and the Grove Pond samples when compared to the background sample.

In addition, the Plow Shop Pond and Grove Pond samples did not have a statistically significant effect on *C. dubia* reproduction when compared to the background sample. All brooders but one in the background samples had three or more broods with an average total number of 42 (F1-Plow Shop Pond) and 44 (F1-Grove Pond) neonates. The number of surviving brooders with three or more broods in the Grove Pond samples ranged from 7 to 10 and the average number of neonates per surviving brooder ranged from 41 to 49. The number of surviving brooders with 3 or more broods in the Plow Shop samples ranged from 7 to 10 and the average number of neonates per surviving brooder ranged from 38 to 53. Based on Dunnett's Multiple Comparison Test and Steel's Many-One Rank Test none of the water samples from Plow Shop Pond and Grove Pond had a significant impact on reproduction for *C. dubia* when compared to the background samples.

5.2. P. promelas

The *P. promelas* toxicity test met and exceeded the test acceptability criteria for survival and growth. Based on Dunnett's Multiple Comparison Test, none of the Plow Shop and Grove Pond samples had a significant impact on survival or growth when compared to the background sample.

Based on these data, its concluded that the surface water samples collected from Grove Pond and Plow Shop Pond were not chronically toxic to sensitive life stages of *C. dubia* and *P. promelas*.

6.0 REFERENCES

U. S. Environmental Protection Agency. 1994. Short-Term Methods For Estimating The Chronic Toxicity Of Effluents and Receiving Waters To Freshwater Organisms, 3rd edition, EPA/600/4-91/002, July 1994

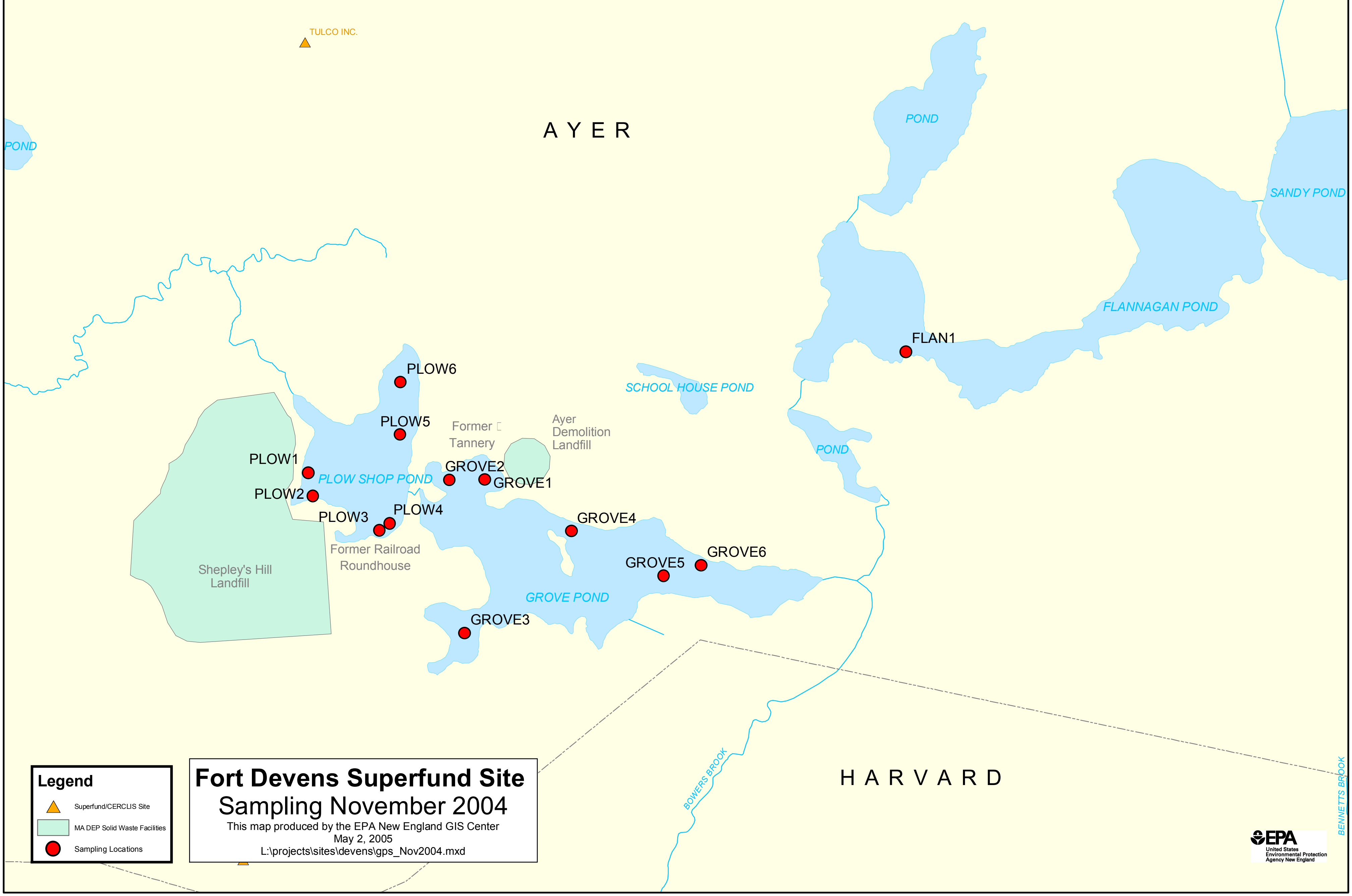
CETIS v1.0.25b. Tidepool Scientific Software. Copyright 2001-2004. Michael A. Ives.

U.S. Environment Protection Agency. 1999. Screening-Level Ecological Risk Assessment - Fort Devens. April 19,1999.

Appendix A

Surface Water Sampling Stations

2004 Surface Water Samples for Toxicity Testing and Chemical Analysis of Devens Ponds



Appendix B

Chain-of-Custody Records

REGION 1

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
04110008	FORT DEVENS

SAMPLERS: *(Signature)* Bart Hoskins + Alice Brennan

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	$DMMSW / METBCW (F)	$MTMSW / METRC (W)	PESW (PEST/PCBS)	TXCCD	TXCFH	REMARKS
	11/3/04			✓	56312 - Grove 1	3	1	1	1	1	1	
	↓			✓	56313 - Grove 2	8	1	1	6	1	1	QA for PEST/PCBS
				✓	56314 - Grove 3	3	1	1	1	1	1	
				✓	56315 - Grove 4	3	1	1	1	1	1	
				✓	56316 - Grove 5	3	1	1	1	1	1	
				✓	56317 - Grove 6	3	1	1	1	1	1	
				✓	56318 - Plow 1	3	1	1	1	1	1	
				✓	56319 - Plow 2	3	1	1	1	1	1	
				✓	56320 - Plow 3	3	1	1	1	1	1	
				✓	56321 - Plow 4	3	1	1	1	1	1	
				✓	56322 - Plow 5	3	1	1	1	1	1	
				✓	56323 - Plow 6	3	1	1	1	1	1	
				✓	56324 - Flan 1	3	1	1	1	1	1	
				✓	56325 - Grove 2 Dup	3	1	1	1	1	1	
	↓			✓	56326 - FB	1	1					Field Blank

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
Bart Hoskins	11/3/04 1930	(See Remarks)			
Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*

Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by: *(Signature)*	Date / Time	Remarks
Bart Hoskins	11/4/04 1145	[signature] BAT	11/4/04 11:45	Placed in Room 190 OEME walkin refrigerator at 1930 on 11/3/04 ~~[illegible]~~ Logged in on 11/4/04

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

1-13724

Appendix C

Toxicity Test Chemistry Summary

Ceriodaphnia dubia **Aquatic Toxicity 8 day Exposure Test Grove Pond**

C. dubia **8 day Exposure Test** **Initial Chemistry - Day 0 (11/04/04)**						
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)*	Hardness (mg/L $CaCo_3$)	Alkalinity (mg/L $CaCo_3$)
G-1	7.34	7.01	24.65	541	80	53.5
G-2	8.29	6.93	24.59	434	64	59
G-3	8.73	6.71	24.58	254	52	27
G-4	8.44	6.64	24.56	281	40	21.5
G-5	8.62	6.67	24.64	277	40	22
G-6	6.17	6.60	24.68	285	44	23
F-1	7.83	7.16	24.64	159.6	20	14
Control	7.01	7.85	24.52	256	66	49.5

*Note: 1 microsiemen/cm (µS/cm) = 1 micromho/cm (µmho/cm)

C. dubia **8 day Exposure Test** **Waste Chemistry - Day 1 (11/05/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
G-1	--	--	--	--
G-2	--	--	--	--
G-3	--	--	--	--
G-4	--	--	--	--
G-5	--	--	--	--
G-6	--	--	--	--
F-1	--	--	--	--
Control	--	--	--	--

– Data was not recorded for this day

C. dubia **8 day Exposure Test** **Waste Chemistry - Day 2 (11/06/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
G-1	5.76	7.43	24.70	533
G-2*	6.92	7.60	24.32	693
G-3	6.10	7.21	24.83	254
G-4	6.30	7.22	24.97	280

Fort DevensAquatic Toxicity Test
Aquatic Toxicity Test Chemistry
Ceriodaphnia dubia

C. dubia **8 day Exposure Test** **Waste Chemistry - Day 2 (11/06/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
G-5	5.71	7.16	25.00	278
G-6	6.24	7.18	25.04	285
F-1	5.94	7.18	25.09	162.7
Control	5.93	7.72	24.92	259

* Small volume due to spill

C. dubia **8 day Exposure Test** **Waste Chemistry - Day 3 (11/07/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
G-1	5.48	7.50	25.13	524
G-2	5.78	7.50	25.13	426
G-3	5.88	7.25	25.09	257
G-4	6.40	7.22	24.99	279
G-5	5.88	7.19	25.02	279
G-6	5.96	7.15	24.94	286
F-1	6.14	7.09	25.03	164.3
Control	5.73	7.57	25.00	261

C. dubia **8 day Exposure Test** **Waste Chemistry - Day 4 (11/08/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
G-1	6.25	7.53	24.85	526
G-2	6.38	7.54	24.85	428
G-3	5.77	7.28	24.78	257
G-4	6.68	7.25	24.77	284
G-5	6.66	7.24	24.81	280
G-6	6.42	7.17	24.84	288
F-1	6.52	7.12	24.87	167.6
Control	6.28	7.61	24.90	262

C. dubia **8 day Exposure Test** **Waste Chemistry - Day 5 (11/09/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
G-1	5.65	7.48	24.63	526
G-2	5.30	7.52	24.60	433
G-3	5.86	7.26	24.90	255
G-4	5.95	7.19	24.82	285
G-5	5.99	7.15	24.86	281
G-6	5.82	7.14	24.66	290
F-1	5.67	7.02	24.86	167.5
Control	5.82	7.59	24.89	262

C. dubia **8 day Exposure Test** **Waste Chemistry - Day 6 (11/10/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
G-1	6.00	7.33	24.61	528
G-2	6.12	7.74	24.60	431
G-3	6.20	7.13	24.72	259
G-4	6.46	7.11	24.67	286
G-5	6.43	7.05	24.80	282
G-6	6.37	7.11	24.76	291
F-1	5.80	6.67	24.79	169.3
Control	6.12	7.34	24.89	257

C. dubia **8 day Exposure Test** **Waste Chemistry - Day 7 (11/11/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
G-1	5.54	7.46	25.30	528
G-2	5.78	7.49	24.98	431
G-3	5.80	7.24	24.91	257
G-4	6.05	7.21	24.94	286
G-5	6.14	7.19	24.91	282
G-6	5.82	7.13	24.92	290

C. dubia **8 day Exposure Test** **Waste Chemistry - Day 7 (11/11/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (μmhos/cm)
F-1	5.83	7.03	24.89	168.4
Control	5.86	7.56	24.93	253

C. dubia **8 day Exposure Test** **Waste Chemistry - Day 8 (11/12/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (μmhos/cm)
G-1	5.88	7.26	24.94	525
G-2	5.71	7.29	24.99	428
G-3	5.94	6.96	25.00	255
G-4	7.25	6.93	24.98	281
G-5	7.29	6.99	25.00	278
G-6	6.70	6.91	24.92	287
F-1	6.84	6.78	24.97	165.4
Control	6.93	7.33	25.03	246

Ceriodaphnia dubia **Aquatic Toxicity 8 day Exposure Test Plow Shop Pond**

C. dubia **8 day Exposure Test** **Initial Chemistry - Day 0 (11/04/04)**						
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)*	Hardness (mg/L $CaCo_3$)	Alkalinity (mg/L $CaCo_3$)
PS-1	7.55	6.71	24.58	245	38	29
PS-2	8.86	6.80	24.57	238	36	24
PS-3	8.12	6.79	24.63	239	34	20.5
PS-4	8.71	6.84	24.57	238	32	20
PS-5	8.42	6.82	24.55	245	36	19
PS-6	6.84	6.78	24.56	245	32	19.5
F-1	7.83	7.16	24.64	159.6	20	14
Control	7.01	7.85	24.52	256	66	49.5

*Note: 1 microsiemen/cm (µS/cm) = 1 micromho/cm (µmho/cm)

C. dubia **8 day Exposure Test** **Waste Chemistry - Day 1 (11/05/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
PS-1	6.79	7.43	24.77	249
PS-2	7.00	7.48	24.89	239
PS-3	6.82	7.42	24.94	239
PS-4	6.92	7.45	24.82	239
PS-5	6.47	7.31	24.81	247
PS-6	6.41	7.29	24.93	248
F-1	6.53	7.27	24.86	165.5
Control	6.82	7.87	24.93	253

C. dubia **8 day Exposure Test** **Waste Chemistry - Day 2 (11/06/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
PS-1	6.22	7.40	24.85	241
PS-2	6.35	7.32	24.96	241
PS-3	6.48	7.37	24.75	242
PS-4	6.39	7.28	24.84	247

Fort Devens Aquatic Toxicity Test
Aquatic Toxicity Test Chemistry
Ceriodaphnia dubia

***C. dubia* 8 day Exposure Test** **Waste Chemistry - Day 2 (11/06/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
PS-5	6.44	7.26	24.87	247
PS-6	5.57	7.20	24.88	250
F-1	6.50	7.19	24.92	164.7
Control	5.95	7.69	24.90	261

***C. dubia* 8 day Exposure Test** **Waste Chemistry - Day 3 (11/07/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
PS-1	6.57	7.33	24.90	202
PS-2	6.45	7.28	24.91	240
PS-3	6.16	7.29	24.90	242
PS-4	6.95	6.80	24.58	19.48
PS-5	6.37	7.18	24.83	246
PS-6	6.00	7.14	24.89	250
F-1	6.14	7.09	24.89	164.0
Control	6.06	7.64	24.91	259

***C. dubia* 8 day Exposure Test** **Waste Chemistry - Day 4 (11/08/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
PS-1	6.53	7.07	24.74	261
PS-2	6.26	7.14	24.84	243
PS-3	6.48	7.10	24.70	244
PS-4	6.68	7.30	24.81	246
PS-5	6.24	7.14	24.86	249
PS-6	5.69	7.09	24.92	251
F-1	5.89	6.97	24.97	167.1
Control	6.30	7.53	25.05	263

Fort Devens Aquatic Toxicity Test
Aquatic Toxicity Test Chemistry
Ceriodaphnia dubia

***C. dubia* 8 day Exposure Test** **Waste Chemistry - Day 5 (11/09/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (μmhos/cm)
PS-1	5.46	7.33	24.74	250
PS-2	5.69	7.23	24.72	251
PS-3	5.98	7.21	24.78	245
PS-4	6.27	7.33	24.78	252
PS-5	5.77	7.13	24.72	250
PS-6	5.79	7.13	24.74	251
F-1	5.31	7.02	24.59	167.7
Control	5.47	7.64	24.57	262

***C. dubia* 8 day Exposure Test** **Waste Chemistry - Day 6 (11/10/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (μmhos/cm)
PS-1	5.95	7.12	24.90	250
PS-2	6.24	7.08	24.65	244
PS-3	6.07	6.99	24.83	246
PS-4	6.56	7.17	24.48	261
PS-5	6.11	7.00	24.62	251
PS-6	6.02	6.98	24.86	252
F-1	6.01	6.85	24.90	171.3
Control	6.38	7.40	24.94	259

***C. dubia* 8 day Exposure Test** **Waste Chemistry - Day 7 (11/11/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (μmhos/cm)
PS-1	6.14	7.37	24.76	252
PS-2	5.82	7.28	24.88	241
PS-3	5.72	7.22	24.92	246
PS-4	6.10	7.29	24.88	252

C. dubia **8 day Exposure Test** **Waste Chemistry - Day 7 (11/11/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (μmhos/cm)
PS-5	6.06	7.20	24.86	252
PS-6	5.69	7.14	24.89	252
F-1	5.74	7.06	24.94	166.4
Control	6.07	7.62	24.91	258

C. dubia **8 day Exposure Test** **Waste Chemistry - Day 8 (11/12/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (μmhos/cm)
PS-1	7.05	7.10	24.97	248
PS-2	6.88	7.02	24.97	241
PS-3	7.06	6.95	24.97	244
PS-4	7.37	7.06	24.85	251
PS-5	7.22	6.97	24.93	247
PS-6	6.99	6.93	24.95	249
F-1	6.84	6.81	24.96	166.7
Control	6.93	7.35	24.70	247

Pimephales promelas Aquatic Toxicity 7 day Exposure Test For Grove Pond

P. promelas 7 day Exposure Test
Initial Chemistry - Day 0 (11/04/04)

Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)*	Hardness (mg/L $CaCo_3$)	Alkalinity (mg/L $CaCo_3$)
G-1	7.34	7.01	24.65	541	80	53.5
G-2	8.29	6.93	24.59	434	64	59
G-3	8.73	6.71	24.58	254	52	27
G-4	8.44	6.64	24.56	281	40	21.5
G-5	8.62	6.67	24.64	277	40	22
G-6	6.17	6.60	24.68	285	44	23
F-1	7.83	7.16	24.64	159.6	20	14
Control	6.28	8.07	24.78	201	56	51

*Note: 1 microsiemen/cm (µS/cm) = 1 micromho/cm (µmho/cm)

P. promelas 7 day Exposure Test
Waste Chemistry - Day 1 (11/05/04)

Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
G-1	6.73	7.52	24.13	536
G-2	6.85	7.53	24.03	439
G-3	7.09	7.27	24.03	258
G-4	6.15	7.14	24.08	286
G-5	6.93	7.11	24.21	280
G-6	6.73	7.17	24.19	290
F-1	6.75	7.08	24.30	162.6
Control	6.53	7.71	24.15	204

P. promelas 7 day Exposure Test
Waste Chemistry - Day 2 (11/06/04)

Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
G-1	5.04	7.27	24.08	531
G-2	4.88	7.32	24.08	435
G-3	4.97	6.99	24.12	253
G-4	5.37	6.93	24.10	284
G-5	4.96	6.95	24.26	281
G-6	4.04	6.94	24.11	285

P. promelas **7 day Exposure Test** **Waste Chemistry - Day 2 (11/06/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
F-1	5.52	6.81	24.44	161.8
Control	4.84	7.38	24.45	202

P. promelas **7 day Exposure Test** **Waste Chemistry - Day 3 (11/07/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
G-1	5.22	7.28	24.02	534
G-2	4.63	7.28	24.06	435
G-3	5.15	6.97	24.10	254
G-4	6.32	7.05	24.07	281
G-5	5.30	6.91	24.21	282
G-6	6.01	6.99	24.20	287
F-1	5.18	6.74	24.24	160.3
Control	5.36	7.45	24.25	203

P. promelas **7 day Exposure Test** **Waste Chemistry - Day 4 (11/08/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
G-1	4.32	7.31	24.10	541
G-2	4.64	7.33	24.10	439
G-3	4.70	7.04	24.06	260
G-4	4.79	6.94	24.17	285
G-5	4.24	6.93	24.33	285
G-6	4.58	6.95	24.27	293
F-1	4.45	6.78	24.25	165.5
Control	4.92	7.47	24.27	207

P. promelas **7 day Exposure Test** **Waste Chemistry - Day 5 (11/09/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
G-1	4.19	7.13	24.49	545
G-2	4.61	7.18	24.46	441

***P. promelas* 7 day Exposure Test** **Waste Chemistry - Day 5 (11/09/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
G-3	4.30	6.88	24.41	265
G-4	4.16	6.76	24.41	292
G-5	4.22	6.80	24.49	292
G-6	4.02	6.77	24.51	298
F-1	4.12	6.65	24.56	172.4
Control	4.27	7.23	24.42	212

***P. promelas* 7 day Exposure Test** **Waste Chemistry - Day 6 (11/10/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
G-1	6.08	7.34	24.08	547
G-2	3.94	7.21	24.78	440
G-3	4.22	6.92	24.67	262
G-4	3.91	6.79	24.64	288
G-5	3.96	6.80	24.71	287
G-6	3.96	6.80	24.73	293
F-1	4.02	6.68	24.73	169.9
Control	4.82	7.31	24.66	207

***P. promelas* 7 day Exposure Test** **Waste Chemistry - Day 7 (11/11/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
G-1	4.25	7.20	24.96	543
G-2	3.93	7.22	24.93	441
G-3	4.26	6.87	24.87	262
G-4	4.46	6.83	24.88	289
G-5	3.99	6.82	24.83	290
G-6	4.51	6.85	24.85	292
F-1	4.59	6.72	24.88	171.9
Control	4.82	7.32	24.88	207

Pimephales promelas **Aquatic Toxicity 7 day Exposure Test For Plow Shop Pond**

P. promelas **7 day Exposure Test Initial Chemistry - Day 0 (11/04/04)**						
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)*	Hardness (mg/L $CaCo_3$)	Alkalinity (mg/L $CaCo_3$)
PS-1	7.55	6.71	24.58	245	38	29
PS-2	8.86	6.80	24.57	238	36	24
PS-3	8.12	6.79	24.63	239	34	20.5
PS-4+	8.04	7.00	24.75	240	36	19
PS-5	8.42	6.82	24.55	245	36	19
PS-6	6.84	6.78	24.56	245	32	19.5
F-1	7.83	7.16	24.64	159.6	20	14
Control	6.28	8.07	24.78	201	56	51

*Note: 1 microsiemen/cm (µS/cm) = 1 micromho/cm (µmho/cm)
+ Plow Shop 4 re-sampled on 11/04/04 because the cubetainer was leaking.

P. promelas **7 day Exposure Test Waste Chemistry - Day 1 (11/05/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
PS-1	6.75	7.31	24.02	246
PS-2	6.96	7.25	24.16	238
PS-3	5.77	7.18	24.02	239
PS-4	6.81	7.14	24.21	239
PS-5	7.01	7.15	24.29	247
PS-6	6.80	7.13	24.35	247
F-1	6.75	7.08	24.30	162.6
Control	6.53	7.71	24.15	204

P. promelas **7 day Exposure Test Waste Chemistry - Day 2 (11/06/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
PS-1	4.76	6.99	24.20	245
PS-2	5.37	7.02	24.16	238
PS-3	4.88	6.93	24.33	240
PS-4	5.23	6.91	24.33	244
PS-5	5.39	6.95	24.36	245

P. promelas **7 day Exposure Test**
Waste Chemistry - Day 2 (11/06/04)

Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
PS-6	4.47	6.94	24.39	244
F-1	5.52	6.81	24.44	161.8
Control	4.84	7.38	24.45	202

P. promelas **7 day Exposure Test**
Waste Chemistry - Day 3 (11/07/04)

Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
PS-1	5.46	7.07	24.20	245
PS-2	6.11	7.13	24.19	242
PS-3	5.70	6.95	24.21	242
PS-4	6.10	7.01	24.23	248
PS-5	6.29	7.00	24.25	245
PS-6	5.64	6.95	24.20	253
F-1	5.18	6.74	24.24	160.3
Control	5.36	7.45	24.25	203

P. promelas **7 day Exposure Test**
Waste Chemistry - Day 4 (11/08/04)

Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
PS-1	4.77	7.08	24.11	251
PS-2	4.50	6.98	24.18	242
PS-3	4.85	6.96	24.11	247
PS-4	4.89	6.95	24.18	252
PS-5	4.81	6.90	24.29	253
PS-6	4.87	6.91	24.30	254
F-1	4.45	6.78	24.25	165.5
Control	4.92	7.47	24.27	207

P. promelas **7 day Exposure Test**
Waste Chemistry - Day 5 (11/09/04)

Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (µmhos/cm)
PS-1	4.06	6.89	24.49	256
PS-2	4.12	6.87	24.43	250
PS-3	4.02	6.79	24.48	252

P. promelas **7 day Exposure Test** **Waste Chemistry - Day 5 (11/09/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (μmhos/cm)
PS-4	4.01	6.79	24.46	261
PS-5	4.11	6.75	24.45	259
PS-6	4.33	6.78	24.56	260
F-1	4.12	6.65	24.56	172.4
Control	4.27	7.23	24.42	212

P. promelas **7 day Exposure Test** **Waste Chemistry - Day 6 (11/10/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (μmhos/cm)
PS-1	3.80	6.90	24.61	253
PS-2	3.97	6.89	24.62	248
PS-3	3.75	6.81	24.56	252
PS-4	4.08	6.81	24.59	257
PS-5	3.87	6.76	24.58	255
PS-6	4.71	6.80	24.61	286
F-1	4.02	6.68	24.73	169.9
Control	4.82	7.31	24.66	207

P. promelas **7 day Exposure Test** **Waste Chemistry - Day 7 (11/11/04)**				
Sample ID	DO (mg/L)	pH	Temperature (°C)	Conductivity (μmhos/cm)
PS-1	4.10	6.93	24.83	254
PS-2	4.46	6.91	24.83	249
PS-3	4.20	6.82	24.84	246
PS-4	3.99	6.81	24.83	256
PS-5	4.44	6.79	24.78	256
PS-6	4.40	6.80	24.82	258
F-1	4.59	6.72	24.88	171.9
Control	4.82	7.32	24.88	207

Appendix D

Bench Sheets and Statistical Test Print-outs

GROVE POND - PLOW SHOP POND - FLANNAGAN POND - CONTROL

	G 5-5	G 1-7	G 6-7	F-9	C-2	G 2-4	G 5-4	G 4-8	G 1-1	F-8	Date/ Init.
1	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/05/04 MF
2	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/06/04 MF
3	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/07/04 MF
4	MF ✓ 11/08/04 — X	MF ✓ 11/08/04 6 X	MF ✓ 11/08/04 8 X	MF ✓ 11/08/04 3 X	MF ✓ 11/08/04 — X	✓ 8	✓ 4	✓ 2	✓ 3	✓ 4	11/08/04 MF
5	✓ 9	✓ 13	✓ 13	✓ 12	✓ 9	✓ 11	✓ 16	✓ 13	✓ 14	✓ 12	11/09/04 MF
6	✓ 13	✓ 20	✓ 15	✓ 14	✓ —	D —	✓ 19	✓ 12	✓ —	✓ 14	11/10/04 MF
7	✓ 15	✓ —	✓ —	✓ —	✓ 12		✓ —	✓ —	✓ 15	✓ —	11/11/04 MF
8	✓ —	✓ 22	✓ 18	✓ 19	✓ 17		✓ 16	✓ 16	✓ 14	✓ 5	11/12/04 MF
Total	37	61	54	48	38	D/19	55	43	46	35	

	G 5-8	C-7	F-2	C-6	G 6-9	G 1-2	G 5-10	G 4-3	G 2-7	G 5-9	Date/ Init.
1	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/05/04 MF
2	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/06/04 MF
3	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/07/04 MF
4	✓ 8	✓ —	✓ 5	✓ —	✓ 5	✓ 6	✓ —	✓ 5	✓ 2	✓ 5	11/08/04 MF
5	✓ 14	✓ 7	✓ 9	✓ 8	✓ 12	✓ 13	✓ 8	✓ 11	✓ 6	✓ 15	11/09/04 MF
6	✓ 17	✓ —	✓ —	✓ —	✓ 11	✓ 14	✓ 6	✓ —	✓ 3	✓ 7	11/10/04 MF
7	✓ —	✓ 12	✓ 11	✓ 10	✓ —	✓ —	✓ 14	✓ 17	✓ 5	✓ —	11/11/04 MF
8	✓ 17	✓ 12	✓ 4	✓ 15	✓ 25	✓ 19	✓ —	✓ 21	✓ 8	✓ 13	11/12/04 MF
Total	56	31	29	33	53	52	28	54	24	40	

	C-9	G 3-10	G 6-8	G 1-4	G 6-2	G 3-6	G 5-6	F-5	G 1-3	F-1	Date/ Init.
1	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/05/04 AF
2	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/06/04 AF
3	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/07/04 AF
4	✓ —	✓ 7	✓ 8	✓ —	✓ 8	✓ 8	✓ 3	✓ 6	✓ 8	✓ 7	11/08/04 AF
5	✓ 10	✓ 13	✓ 12	✓ —	✓ 13	✓ 13	✓ 11	✓ 6	✓ 14	✓ 12	11/09/04 AF
6	✓ —	✓ 15	✓ 17	✓ —	✓ 14	✓ 14	✓ AF 11/10/04 — ~~14~~	✓ AF 11/10/04 ~~14~~	AF 11/10/04 ~~12~~ 5	✓ 12	11/10/04 AF
7	✓ 14	✓ —	✓ —	✓ —	✓ —	✓ —	✓ 16	✓ —	✓ —	✓ —	11/11/04 AF
8	✓ 14	✓ 23	✓ 19	✓ —	✓ 14	✓ 22	✓ 23	✓ 18	✓ 8	✓ 18	11/12/04 AF
Total	38	58	56	—	49	57	53	44	37	49	

	G 6-1	G 2-9	C-3	G 4-2	G 5-2	G 5-1	G 4-6	G 4-7	G 3-3	G 2-1	Date/ Init.
1	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/05/04 AF
2	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/06/04 AF
3	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/07/04 AF
4	✓ 6	✓ 7	✓ —	✓ 5	✓ —	✓ —	✓ —	✓ 6	✓ 4	✓ 8	11/08/04 AF
5	✓ 12	✓ 15	✓ 9	✓ 12	✓ 4	✓ 7	✓ 5	✓ 14	✓ 12	✓ 13	11/09/04 AF
6	✓ 17	✓ 23	✓ —	✓ 12	✓ 8	✓ 14	✓ 10	✓ 15	✓ 16	✓ 18	11/10/04 AF
7	✓ —	✓ —	✓ 16	✓ 4	✓ —	✓ —	✓ 16	✓ —	✓ —	✓ —	11/11/04 AF
8	✓ 21	✓ 21	✓ 20	✓ 12	✓ 17	✓ 20	✓ —	✓ 13	✓ 23	✓ 24	11/12/04 AF
Total	56	66	45	45	29	41	31	48	55	63	

GROVE POND - PLOW SHOP POND - FLANNAGAN POND - CONTROL

	F-7	C-5	G 6-4	G 1-10	G 1-5	G 1-9	G 1-8	G 2-2	G 4-1	C-1	Date/ Init.
1	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/05/04 MF
2	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/06/04 MF
3	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/07/04 MF
4	✓ 6	✓ —	✓ 5	✓ 7	✓ 7	✓ 6	✓ 6	✓ 6	✓ 3	✓ —	11/08/04 MF
5	✓ 12	✓ 11	✓ 13	✓ 14	✓ 16	✓ 14	✓ 12	✓ 13	✓ 11	✓ 2	11/09/04 MF
6	✓ 14	✓ —	✓ 10	✓ —	✓ 9	✓ —	✓ 17	✓ 12	✓ 16	✓ —	11/10/04 MF
7	✓ —	✓ 13	✓ —	✓ 20	✓ —	✓ 13	✓ —	✓ —	✓ —	✓ 7	11/11/04 MF
8	✓ 21	✓ 21	✓ 10	✓ 16	✓ 11	✓ 12	✓ 17	✓ 17	✓ 21	✓ 9	11/12/04 MF
Total	53	45	38	57	43	45	52	48	51	18	

✓

	G 2-10	G 3-9	F-6	G 2-6	G 3-1	F-3	C-10	G 4-5	G 6-5	G 3-4	Date/ Init.
1	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	D	✓ —	11/05/04 MF
2	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —		✓ —	11/06/04 MF
3	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —		✓ —	11/07/04 MF
4	✓ 8	✓ 7	✓ 5	✓ 7	✓ 4	✓ 5	✓ —	✓ 6		✓ 5	11/08/04 MF
5	✓ 8	✓ 11	✓ 10	✓ 11	✓ 11	✓ 13	✓ 7	✓ 12		✓ 12	11/09/04 MF
6	✓ 13	✓ —	✓ 13	✓ —	✓ 5	✓ 13	✓ —	✓ —		✓ 11	11/10/04 MF
7	✓ —	✓ 13	✓ —	✓ 12	✓ —	✓ —	✓ 12	✓ 21		✓ —	11/11/04 MF
8	✓ 8	✓ 24	✓ 20	D —	✓ 2	✓ 19	✓ 20	✓ 25		✓ 12	11/12/04 MF
Total	37	55	48	D/30	22	50	39	64	D/—	40	

✓

GROVE POND - PLOW SHOP POND - FLANNAGAN POND - CONTROL

	G 4-4	G 2-8	F-4	G 6-10	G 2-5	G 6-3	G 3-5	G 5-3	G 4-9	G 3-8	Date/ Init.
1	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/05/04 AF
2	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/06/04 AF
3	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/07/04 AF
4	✓ 4	✓ 6	✓ 5	✓ 5	✓ 7	✓ 5	✓ —	✓ —	✓ 4	✓ 9	11/08/04 AF
5	✓ 13	✓ 13	✓ 11	✓ 9	✓ 11	✓ 10	✓ 8	✓ 3	✓ 11	✓ 13	11/09/04 AF
6	✓ — ~~6~~ AF 11/10/04	✓ 6	✓ 13	✓ —	✓ —	✓ (—) ~~12~~ AF 11/10/04	✓ (12) ~~16~~ AF 11/10/04	✓ (16) ~~14~~ AF 11/10/04	✓ (14) ~~14~~ AF 11/10/04	✓ —	11/10/04 AF
7	✓ 21	D 9	✓ —	✓ 6	✓ 13	✓ 4	✓ 13	✓ —	✓ —	✓ 20	11/11/04 AF
8	✓ 21	|	✓ 10	✓ 16	✓ 14	✓ 5	✓ —	✓ 19	P 12	✓ 24	11/12/04 AF
Total	59	D/34	39	36	45	24	33	38	D/41	66	

✓

	G 5-7	G 2-3	C-8	C-4	G 1-6	G 4-10	F-10	G 6-6	G 3-7	G 3-2	Date/ Init.
1	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/05/04 AF
2	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/06/04 AF
3	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/07/04 AF
4	✓ 6	✓ 6	✓ 4	✓ —	✓ 6	✓ 7	✓ 6	✓ 6	✓ 6	✓ 5	11/08/04 AF
5	✓ 11	✓ 13	✓ 11	✓ 12	✓ 14	✓ 14	✓ 13	✓ 16	✓ 12	✓ 15	11/09/04 AF
6	✓ —	✓ —	✓ —	✓ 12	✓ 13	✓ —	✓ 13	✓ —	✓ 14	✓ 8	11/10/04 AF
7	✓ 12	✓ 12	✓ 17	✓ —	✓ 5	✓ 17	✓ —	✓ 13	✓ —	✓ —	11/11/04 AF
8	✓ 12	✓ 4	✓ 19	✓ 17	✓ 27	D 2	✓ 22	✓ 13	✓ 20	✓ 25	11/12/04 AF
Total	41	35	51	41	65	D/40	54	48	52	53	

✓

GROVE POND - PLOW SHOP POND - FLANNAGAN POND - CONTROL

	PS 2-10	PS 3-4	PS 2-4	F-9	PS 5-9	PS 6-3	PS 1-10	PS 4-5	PS 4-1	PS 6-7	Date/ Init.
1	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/05/04 MF
2	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/06/04 MF
3	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/07/04 MF
4	✓ 6	✓ 7	✓ 7	✓ 7	✓ 7	✓ 7	✓ 4	✓ 5	✓ 7	✓ 5	11/08/04 MF
5	✓ 10	✓ 13	✓ 12	✓ 9	✓ 8	✓ 12	✓ 14	✓ 9	✓ 10	✓ 16	11/09/04 MF
6	✓ 16	✓ —	✓ 16	✓ 16	✓ 11	✓ —	✓ 17	✓ 12	✓ 16	✓ 13	11/10/04 MF
7	✓ —	✓ 19	✓ —	✓ —	✓ —	✓ 16	✓ —	✓ —	✓ —	✓ —	11/11/04 MF
8	✓ 24	✓ 13	✓ 14	✓ 21	✓ 18	✓ 19	✓ 15	✓ 17	✓ 24	✓ 28	11/12/04 MF
Total	56	52	49	53	44	54	50	43	57	62	

✓

	PS 2-5	PS 2-3	PS 6-2	PS 6-5	F-7	F-5	PS 4-4	PS 4-8	PS 2-9	PS 3-9	Date/ Init.
1	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/05/04 MF
2	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/06/04 MF
3	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/07/04 MF
4	✓ 8	✓ 7	✓ 5	✓ 3	✓ 5	✓ 7	✓ —	✓ 3	✓ 8	✓ 7	11/08/04 MF
5	✓ 11	✓ 13	✓ 14	✓ 14	✓ 12	✓ 7	✓ 10	✓ 12	✓ 12	✓ 11	11/09/04 MF
6	✓ —	✓ —	✓ 12	✓ 4	✓ 11	✓ 1	✓ 14	✓ 9	✓ 13	✓ 17	11/10/04 MF
7	✓ 13	✓ 10	✓ —	✓ —	✓ —	✓ 16	✓ —	✓ —	✓ —	✓ —	11/11/04 MF
8	✓ 21	✓ 19	✓ 21	✓ 6	✓ 14	✓ 20	✓ 15	✓ 16	23	✓ 20	11/12/04 MF
Total	53	49	52	27	42	51	39	40	D/56	55	

✓

GROVE POND - PLOW SHOP POND - FLANNAGAN POND - CONTROL

	PS 2-2	F-8	F-3	PS 3-3	C-6	C-2	PS 4-9	PS 1-2	C-5	PS 5-6	Date/ Init.
1	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/05/04 MF
2	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/06/04 MF
3	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/07/04 MF
4	✓ 2	✓ —	✓ 4	✓ 4	✓ 5	✓ —	✓ 3	✓ 6	✓ —	✓ —	11/08/04 MF
5	✓ 10	✓ 6	✓ 8	✓ 10	✓ 11	✓ —	✓ 9	✓ 8	✓ 10	✓ 1	11/09/04 MF
6	✓ 8	✓ —	✓ —	✓ 11	D 11/10/04	✓ 9	✓ —	✓ 17	✓ 14	✓ 6	11/10/04 MF
7	✓ —	✓ 2	✓ 13	✓ —	[illegible]	✓ 15	✓ 10	✓ —	✓ —	✓ 5	11/11/04 MF
8	✓ 10	✓ 1	✓ 16	✓ 25		✓ 18	✓ 10	✓ 15	✓ 22	✓ —	11/12/04 MF
Total	30	9	41	50	D/16	42	32	46	46	12	

✓

	C-4	PS 3-2	C-10	PS 3-6	C-8	PS 1-7	PS 6-10	PS 5-8	PS 5-2	PS 3-10	Date/ Init.
1	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/05/04 MF
2	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/06/04 MF
3	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/07/04 MF
4	✓ —	✓ 7	✓ —	✓ 6	D —	✓ 5	✓ 6	✓ 6	✓ —	✓ 4	11/08/04 MF
5	✓ 4	✓ 12	✓ 9	✓ 10		✓ 11	✓ 14	D 7	✓ 7	✓ 12	11/09/04 MF
6	✓ —	✓ 17	✓ 12	✓ 13		✓ —	✓ 1		✓ 11	✓ 6	11/10/04 MF
7	✓ 18	✓ —	✓ —	✓ —		✓ 17	✓ 5		✓ 16	✓ —	11/11/04 MF
8	✓ 11	✓ 13	✓ 19	✓ 20		✓ 23	✓ 11		✓ —	✓ 17	11/12/04 MF
Total	33	49	40	49	D/—	56	37	D/13	34	39	

✓

GROVE POND - PLOW SHOP POND - FLANNAGAN POND - CONTROL

	F-2	PS 2-7	PS 5-7	PS 6-9	PS 6-1	PS 1-9	PS 1-1	C-1	PS 2-6	PS 5-3	Date/ Init.
1	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/05/04 MF
2	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/06/04 MF
3	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/07/04 MF
4	✓ 5	✓ 6	✓ 8	✓ 5	✓ —	✓ 7	✓ —	✓ —	✓ 7	✓ 5	11/08/04 MF
5	✓ 10	✓ 9	✓ 12	✓ 13	✓ 6	✓ 16	✓ 10	✓ 8	✓ 11	✓ 13	11/09/04 MF
6	✓ 11	✓ 12	✓ —	✓ 1	✓ 12	✓ 13	✓ 17	✓ 11	✓ 15	✓ 2	11/10/04 MF
7	✓ —	✓ —	✓ 17	✓ 19	✓ 18	✓ —	✓ —	✓ —	✓ —	✓ —	11/11/04 MF
8	✓ 15	✓ 18	✓ 22	✓ 13	✓ —	✓ 28	✓ 22	D 17	✓ 6	✓ 13	11/12/04 MF
Total	41	45	59	51	36	64	49	D/36	39	33	

✓

C-1 Alive @ 10:30 First Loo[k] Dead @ 13:0[0] During Counts

	PS 4-6	PS 1-6	PS 5-10	PS 5-1	C-7	PS 1-8	PS 2-8	PS 4-10	PS 3-8	PS 2-1	Date/ Init.
1	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/05/04 MF
2	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/06/04 MF
3	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/07/04 MF
4	✓ 7	✓ 5	✓ —	✓ 9	✓ —	✓ 6	✓ 7	D 1	✓ 8	✓ 6	11/08/04 MF
5	✓ 11	✓ 12	✓ 5	✓ 13	✓ 5	✓ 13	✓ 9		✓ 2	✓ 10	11/09/04 MF
6	✓ 16	✓ 20	✓ 4	✓ 16	D 1	✓ 16	✓ 18		✓ 14	✓ 4	11/10/04 MF
7	✓ —	✓ —	✓ —	✓ —		✓ —	✓ —		✓ 2	✓ —	11/11/04 MF
8	✓ 23	✓ 24	✓ 3	✓ 21		✓ 21	✓ 17		✓ 29	✓ 18	11/12/04 MF
Total	57	61	12	59	D/6	56	51	D/1	55	38	

✓

GROVE POND - PLOW SHOP POND - FLANNAGAN POND - CONTROL

	PS 1-3	F-4	PS 4-7	PS 5-5	PS 6-6	F-1	F-6	PS 1-4	PS 4-2	PS 1-5	Date/ Init.
1	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/05/04 MF
2	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/06/04 MF
3	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/07/04 MF
4	✓ 4	✓ 5	✓ —	✓ 6	✓ 6	✓ 6	✓ —	✓ 3	✓ —	✓ 7	11/08/04 MF
5	✓ 14	✓ 11	✓ 12	✓ 10	✓ 11	✓ 10	✓ 7	D 13	✓ 5	✓ 12	11/09/04 MF
6	✓ 12	✓ 13	✓ —	✓ —	✓ 20	✓ 18	✓ 11		✓ 1	✓ 13	11/10/04 MF
7	✓ —	✓ —	✓ 12	✓ 12	✓ —	✓ —	✓ 19		✓ 2	✓ —	11/11/04 MF
8	✓ 22	✓ 26	✓ 7	✓ 21	✓ 24	✓ 22	✓ 17		✓ —	✓ 17	11/12/04 MF
Total	52	55	31	49	61	56	54	D/16	8	49	

	PS 3-7	PS 4-3	PS 3-5	PS 5-4	F-10	C-3	PS 6-4	PS 6-8	PS 3-1	C-9	Date/ Init.
1	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/05/04 MF
2	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/06/04 MF
3	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	✓ —	11/07/04 MF
4	✓ 4	D 3	✓ 5	✓ 7	✓ 6	✓ 5	✓ 8	✓ 7	✓ 9	✓ —	11/08/04 MF
5	✓ 10		✓ 12	✓ 15	✓ 8	✓ 10	✓ 13	✓ 14	✓ 15	✓ 4	11/09/04 MF
6	✓ —		✓ 17	✓ 20	✓ —	✓ 11	✓ —	✓ —	✓ 18	✓ 4	11/10/04 MF
7	✓ 13		✓ —	✓ —	✓ 7	✓ —	✓ 11	✓ 14	✓ —	✓ —	11/11/04 MF
8	✓ 21		✓ 11	✓ 22	✓ 4	✓ 18	✓ 12	✓ 20	✓ 17	✓ 8	11/12/04 MF
Total	48	D/3	45	64	~~24~~ 25	44	44	55	59	16	

Summary of C. dubia Reproduction Data

Replicate	Grove Pond Location 1	Grove Pond Location 2	Grove Pond Location 3	Grove Pond Location 4	Grove Pond Location 5	Grove Pond Location 6	Flannagan Pond	Laboratory Contro1
1	46 *	63 *	22 *	51 *	41 *	56 *	49 *	18 *
2	52 *	48 *	53 *	45 *	29 *	49 *	29 *	38 *
3	37 *	35 *	55 *	54 *	38 *	24 *	50 *	45 *
4	0	19 D	40 *	59 *	55 *	38 *	39 *	41 *
5	43 *	45 *	33 *	64 *	37 *	0 D	44 *	45 *
6	65 *	30 D*	57 *	31 *	53 *	48 *	48 *	33 *
7	61 *	24 *	52 *	48 *	41 *	54 *	53 *	31 *
8	52 *	34 D*	66 *	43 *	56 *	56 *	35 *	51 *
9	45 *	66 *	55 *	41 D*	40 *	53 *	48 *	38 *
10	57 *	37 *	58 *	40 D*	28 *	36 *	54 *	39 *
Total # of Neonates	458	401	491	476	418	414	449	379
Avg # of neonates [a]	45.8	45.4	49.1	49.4	41.8	46	44.9	37.9
Avg # of neonates from 3+ broods [b]	50.9	45.4	49.1	49.4	41.8	46	44.9	37.9

Replicate	Plow Shop Pond Location 1	Plow Shop Pond Location 2	Plow Shop Pond Location 3	Plow Shop Pond Location 4	Plow Shop Pond Location 5	Plow Shop Pond Location 6	Flannagan Pond	Laboratory Contro1
1	49 *	38 *	59 *	57 *	59 *	36 *	56 *	36 D*
2	46 *	30 *	49 *	8	34 *	52 *	41 *	42 *
3	52 *	49 *	50 *	3 D	33 *	54 *	41 *	44 *
4	16 D	49 *	52 *	39 *	64 *	44 *	55 *	33 *
5	49 *	53 *	45 *	43 *	49 *	27 *	51 *	46 *
6	61 *	39 *	49 *	57 *	12	61 *	54 *	16 D
7	56 *	45 *	48 *	31 *	59 *	62 *	42 *	6 D
8	56 *	51 *	55 *	40 *	13 D	55 *	9	0 D
9	64 *	56 D*	55 *	32 *	44 *	51 *	53 *	16 *
10	50 *	56 *	39 *	1 D	12 *	37 *	25 *	40 *
Total # of Neonates	499	466	501	311	379	479	427	279
Avg # of neonates [a]	53.7	45.6	50.1	38.4	40.7	47.9	42.7	36.8
Avg # of neonates from 3+ broods [b]	53.7	45.6	50.1	42.7	44.3	47.9	46.4	36.8

D - Dead brooder

* - 3+ broods

[a] - per surviving brooder

[b] - Average does not include neonates from dead brooders

G:\ALLSHARE\ESATBIO\
DEVENS\TOX TESTS\SW TOX TEST INFO
CD neonate averages.xls

Pimephales promelas CHRONIC TOXICITY TEST FOR FORT DEVENS
(GROVE POND - PLOW SHOP POND - FLANNAGAN POND - CONTROL) IN AYER, MA
START DATE: 11/04/04

	Sample ID	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Notes #ALIVE
TT	G1-1	0	0	0	0	0	0	0	0	10
BB	G1-2	0	0	0	0	0	0	1	1	9
JJ	G1-3	0	0	0	0	2	2	2	2	8
QQ	G1-4	0	0	0	0	0	0	0	0	10
DD	G2-1	0	0	0	0	0	0	0	0	10
NN	G2-2	0	0	0	0	0	0	0	0	10
AA	G2-3	0	0	0	0	0	0	0	0	10
DDD	G2-4	0	0	0	0	0	1	1	1	9
Q	G3-1	0	0	0	0	0	0	0	0	10
Z	G3-2	0	0	0	0	0	0	0	0	10
CCC	G3-3	0	0	0	0	0	0	0	0	10
LL	G3-4	0	0	0	0	0	1	1	1	9
RR	G4-1	0	0	0	0	0	0	0	0	10
H	G4-2	0	0	0	0	0	0	0	0	10
F	G4-3	0	0	0	0	X-0 still alive	0	0	0	10
O	G4-4	0	0	0	0	0	0	0	0	10
M	G5-1	0	0	0	0	0	0	1	1	9
AAA	G5-2	0	0	0	0	0	0	0	0	10
HH	G5-3	0	0	0	0	0	0	1	1	9
FF	G5-4	0	0	0	0	0	0	0	0	10
C	G6-1	0	0	0	0	0	0	0	0	10
A	G6-2	0	0	0	0	0	0	0	0	10
L	G6-3	0	0	0	0	0	0	0	0	10
T	G6-4	0	had 11 took one out 0	0	0	0	0	0	0	10
		11/04/04 MMG RAR QC-AF	11/05/04 MMG RAR EW	11/06/04 MMG EW RAR AF	11/07/04 MMG EW RAR	11/08/04 MMG EW RAR	11/9/04 EW MMG RAR	11/10/04 EW MMG RAR	11/11/04 EW	

Pimephales promelas CHRONIC TOXICITY TEST FOR FORT DEVENS
(GROVE POND - PLOW SHOP POND - FLANNAGAN POND - CONTROL) IN AYER, MA
START DATE: 11/04/04

		Sample ID	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Notes # ALIVE
XX		PS1-1	0	0	0	0	0	0	0	0	10
S		PS1-2	0	0	0	0	0	0	0	0	10
EE		PS1-3	0	0	0	0	0	0	0	0	10
D		PS1-4	0	1 squished RAR	2	2	2	2	2	2	8
I		PS2-1	0	0	0	0	0	0	0	0	18
J		PS2-2	0	0	0	0	0	0	0	0	10
E		PS2-3	0	0	0	0	0	0	0	0	10
WW		PS2-4	0	0 there were 11 - took one out	0	0	0	0	0	0	10
V		PS3-1	0	0	0	0	0	0	0 RAR	0	10
II		PS3-2	0	0	0	0	0	0	~~0~~ 1 RAR	1	9
UU		PS3-3	0	0	0	0	0	0	0	0	10
CC		PS3-4	0	0	0	0	0	0	0	0	10
B		PS4-1	0	0	0	0	1	1	1	1	9
PP		PS4-2	0	0	0	0	0	0	0	0	10
U		PS4-3	0	0	0	0	0	0	0	0	10
K		PS4-4	0	0	0	0	0	0	0	1 ~~0~~ RAR	9
W		PS5-1	0	0	0	0	0	0	0	0	10
G		PS5-2	0	0	0	0	0	0	0	0	10
ZZ		PS5-3	0	0	0	0	0	0	0	0	10
GG		PS5-4	0	0	0	0	0	0	0	0	10
SS		PS6-1	0	0	0	0	0	0	0	0	10
P		PS6-2	0	0	0	0	0	0	0	0	10
MM		PS6-3	0	0	0	0	0	0	1	1	9
VV		PS6-4	0	0	0	0	1	1	1	1	9
			11/04/04 MMG RAR	11/05/04 MMG RAR	11/06/04 MMG AF RAR GW	11/7/04 RAR AF	11/8/04 GW MMG	11/9/04 RAR MMG GW	11/10/04 GW RAR MMG	11/11/04 GW	

QC-AF

Pimephales promelas CHRONIC TOXICITY TEST FOR FORT DEVENS (GROVE POND - PLOW SHOP POND - FLANNAGAN POND - CONTROL) IN AYER, MA

START DATE: 11/04/04

	Sample ID	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Notes
OO [redacted]	F-1	0	0	0	0	0	1	1	1	9
YY [redacted]	F-2	0	0	0	0	0	0	0	0	10
N [redacted]	F-3	0	0	0	0	0	0	0	0	10
BBB [redacted]	F-4	0	0	0	0	0	0	0	0	10
X [redacted]	C-1	0	0	0	0	0	Ø *, 1 RAR	1	1	9
R [redacted]	C-2	0	0	0	1	1	1	1	1	9
Y [redacted]	C-3	0	0	0	0	0	0	0	0	10
KK [redacted]	C-4	0	0	0	0	0	0	0	0	10
		11/04/04 MMG RAR QC-MF	11/05/04 MMG RAR	11/06/04 MF RAR	11/07/04 EW	11/08/04 MMG RAR	11/09/04 EW RAR	11/10/04 MMG RAR	11/11/04 RAR	

* spilt tiny bit couldn't find 1 fish

* found fish dried on side of beaker

Fort Devens P. promelas Chronic Aquatic tox. test – GROVE POND

test start date: test end date:

PAN #	letter	sample ID	Tare Wt.	Total Wt.	# ALIVE
1	TT	G1-1	1.22405	1.22956	10
2	BB	G1-2	1.22344	1.22865	9
3	JJ	G1-3	1.21748	1.22150	8
4	QQ	G1-4	1.22164	1.22742	10
5	DD	G2-1	1.21138	1.21677	10
6	NN	G2-2	1.22223	1.22805	10
7	AA	G2-3	1.22026	1.22598 (RAR)	10
8	DDD	G2-4	1.23000 (RAR)	1.23513	9
9	Q	G3-1	1.22093	1.22663	10
10	Z	G3-2	1.22579	1.23091	10
11	CCC	G3-3	1.22445	1.23092	10
12	LL	G3-4	1.23496	1.24017	9
13	RR	G4-1	1.21835	1.22406	10
14	H	G4-2	1.22257	1.22725	10
15	F	G4-3	1.23066	1.23522	10
16	O	G4-4	1.21731	1.22258	10
17	M	G5-1	1.23047	1.23444	9
18	AAA	G5-2	1.22159	1.22730	10
19	HH	G5-3	1.22423	1.22923	9
20	FF	G5-4	1.24245	1.24797 (RAR)	10
21	C	G6-1	1.21869	1.22334	10
22	A	G6-2	1.22689	1.23230	10
23	L	G6-3	1.21249	1.21796 (RAR)	10
24	T	G6-4	1.21265	1.21830	10
		date:	11/1[illegible]/04		
		initials:	RAR		

Fort Devens P. promelas Chronic Aquatic tox. test PLOW SHOP POND

PAN #	letter	SAMPLE ID	Tare Wt	Total Wt	# ALIVE
25	XX	PS1-1	1.21626	1.22162	10
26	S	PS1-2	1.21871	1.22371	10
27	EE	PS1-3	1.22680	1.23302	10
28	D	PS1-4	1.22491	1.22803	8
29	I	PS2-1	1.21931	1.22588	10
30	J	PS2-2	1.22322	1.22860	10
31	E	PS2-3	1.22757	1.23297	10
32	WW	PS2-4	1.21446	1.22043	10
33	V	PS3-1	1.21729	1.22280	10
34	II	PS3-2	1.21765	1.22236	9
35	UU	PS3-3	1.22928	1.23513	10
36	CC	PS3-4	1.22947	1.23528	10
37	B	PS4-1	1.21461	1.21911	9
38	PP	PS4-2	1.23220	1.23733	10
39	U	PS4-3	1.21575	1.22215	10
40	K	PS4-4	1.22378	1.22905	9
41	W	PS5-1	1.23630	1.24172	10
42	G	PS5-2	1.21940	1.22455	10
43	ZZ	PS5-3	1.21868	1.22400	10
44	GG	PS5-4	1.21825	1.22447	10
45	SS	PS6-1	1.21393	1.21948	10
46	P	PS6-2	1.21602	1.22228	10
47	MM	PS6-3	1.21071	1.21582	9
48	VV	PS6-4	1.21516	1.22071	9
		date:	11/10/04	11/19/04	
		initials:	RAR	RAR	

FORT DEVENS P. promelas
Chronic Aquatic Tox. Test
FLANNAGAN POND & LAB CONTROL

PAN #	Letter	SAMPLE ID	Tare wt.	Total wt.	# ALIVE
49	OO	F-1	1.21109	1.21~~600~~ 598 RAR	9
50	YY	F-2	1.22186	1.22764	10
51	N	F-3	1.20766	1.21378	10
52	BBB	F-4	1.21841	1.22459	10
53	X	C-1	1.21896	1.22324	9
54	R	C-2	1.22330	1.22877	9
55	Y	C-3	1.23533	1.24106	10
56	KK	C-4	1.22245	1.22699	10
		date:	11/11/04	11/19/04	
		initials:	RAR	RAR	

Data Summary for Grove Pond and Plow Shop
P. promelas

Pan #	Replicate	Sample ID	# Exposed	Tare Weight (mg)	Total Weight (mg)	# Alive	Actual Weight (mg)	Mean Dry Weight (mg)	Mean Biomass (mg)
53	X	C-1	10	1218.96	1223.24	9	4.28	0.48	0.43
54	R	C-2	10	1223.3	1228.77	9	5.47	0.61	0.55
55	Y	C-3	10	1235.33	1241.06	10	5.73	0.57	0.57
56	KK	C-4	10	1222.45	1226.99	10	4.54	0.45	0.45
Mean								**0.53**	**0.50**
49	OO	F-1	10	1211.09	1215.98	9	4.89	0.54	0.49
50	YY	F-2	10	1221.86	1227.64	10	5.78	0.58	0.58
51	N	F-3	10	1207.66	1213.78	10	6.12	0.61	0.61
52	BBB	F-4	10	1218.41	1224.59	10	6.18	0.62	0.62
Mean								**0.59**	**0.57**
1	TT	G1-1	10	1224.05	1229.56	10	5.51	0.55	0.55
2	BB	G1-2	10	1223.44	1228.65	9	5.21	0.58	0.52
3	JJ	G1-3	10	1217.48	1221.5	8	4.02	0.50	0.40
4	QQ	G1-4	10	1221.64	1227.42	10	5.78	0.58	0.58
Mean								**0.55**	**0.51**
5	DD	G2-1	10	1211.38	1216.77	10	5.39	0.54	0.54
6	NN	G2-2	10	1222.23	1228.05	10	5.82	0.58	0.58
7	AA	G2-3	10	1220.26	1225.98	10	5.72	0.57	0.57
8	DDD	G2-4	10	1230	1235.13	9	5.13	0.57	0.51
Mean								**0.57**	**0.55**
9	Q	G3-1	10	1220.93	1226.63	10	5.70	0.57	0.57
10	Z	G3-2	10	1225.79	1230.91	10	5.12	0.51	0.51
11	CCC	G3-3	10	1224.45	1230.92	10	6.47	0.65	0.65
12	LL	G3-4	10	1234.96	1240.17	9	5.21	0.58	0.52
Mean								**0.58**	**0.56**
13	RR	G4-1	10	1218.35	1224.06	10	5.71	0.57	0.57
14	H	G4-2	10	1222.57	1227.23	10	4.66	0.47	0.47
15	F	G4-3	10	1230.86	1235.22	10	4.36	0.44	0.44
16	O	G4-4	10	1217.31	1222.58	10	5.27	0.53	0.53
Mean								**0.50**	**0.50**
17	M	G5-1	10	1230.47	1234.44	9	3.97	0.44	0.40
18	AAA	G5-2	10	1221.59	1227.3	10	5.71	0.57	0.57
19	HH	G5-3	10	1224.23	1229.23	9	5.00	0.56	0.50
20	FF	G5-4	10	1242.45	1247.97	10	5.52	0.55	0.55
Mean								**0.53**	**0.51**
21	C	G6-1	10	1218.69	1223.34	10	4.65	0.46	0.46
22	A	G6-2	10	1226.89	1232.3	10	5.41	0.54	0.54
23	L	G6-3	10	1212.49	1217.96	10	5.47	0.55	0.55
24	T	G6-4	10	1212.65	1218.3	10	5.65	0.56	0.56
Mean								**0.53**	**0.53**
25	XX	PS1-1	10	1216.26	1221.62	10	5.36	0.54	0.54
26	S	PS1-2	10	1218.71	1223.71	10	5.00	0.50	0.50
27	EE	PS1-3	10	1226.80	1233.02	10	6.22	0.62	0.62
28	D	PS1-4	10	1224.91	1228.03	8	3.12	0.39	0.31
Mean								**0.51**	**0.49**
29	I	PS2-1	10	1219.31	1225.88	10	6.57	0.66	0.66
30	J	PS2-2	10	1223.22	1228.60	10	5.38	0.54	0.54
31	E	PS2-3	10	1227.57	1232.97	10	5.40	0.54	0.54
32	WW	PS2-4	10	1214.46	1220.43	10	5.97	0.60	0.60
Mean								**0.58**	**0.58**

Data Summary for Grove Pond and Plow Shop
P. promelas

Pan #	Replicate	Sample ID	# Exposed	Tare Weight (mg)	Total Weight (mg)	# Alive	Actual Weight (mg)	Mean Dry Weight (mg)	Mean Biomass (mg)
33	V	PS3-1	10	1217.29	1222.80	10	5.51	0.55	0.55
34	II	PS3-2	10	1217.65	1222.36	9	4.71	0.52	0.47
35	UU	PS3-3	10	1229.28	1235.13	10	5.85	0.59	0.59
36	CC	PS3-4	10	1229.47	1235.28	10	5.81	0.58	0.58
Mean								**0.56**	**0.55**
37	B	PS4-1	10	1214.61	1219.11	9	4.50	0.50	0.45
38	PP	PS4-2	10	1232.20	1237.33	10	5.13	0.51	0.51
39	U	PS4-3	10	1215.75	1222.15	10	6.40	0.64	0.64
40	K	PS4-4	10	1223.78	1229.05	9	5.27	0.59	0.53
Mean								**0.56**	**0.53**
41	W	PS5-1	10	1236.30	1241.72	10	5.42	0.54	0.54
42	G	PS5-2	10	1219.40	1224.55	10	5.15	0.51	0.51
43	ZZ	PS5-3	10	1218.68	1224.00	10	5.32	0.53	0.53
44	GG	PS5-4	10	1218.25	1224.47	10	6.22	0.62	0.62
Mean								**0.55**	**0.55**
45	SS	PS6-1	10	1213.93	1219.48	10	5.55	0.55	0.55
46	P	PS6-2	10	1216.02	1222.28	10	6.26	0.63	0.63
47	MM	PS6-3	10	1210.71	1215.82	9	5.11	0.57	0.51
48	VV	PS6-4	10	1215.16	1220.71	9	5.55	0.62	0.55
Mean								**0.59**	**0.56**

CETIS Data Worksheet

Report Date: 27 Apr-05 10:40 AM
Link: 08-1419-5813/GROVE

Ceriodaphnia 7-d Survival and Reproduction Test | **U.S. EPA Region I Lab**

Start Date: 05 Nov-04 | **Species:** Ceriodaphnia dubia | **Sample Code:** 1104CDCAMGLC
Ending Date: 12 Nov-04 | **Protocol:** EPA/600/4-91/002 (1994) | **Sample Source:** Fort Devens Grove LC SW
Sample Date: 05 Nov-04 | **Material:** Sodium chloride | **Sample Station:** GLC1

Sample Code	Rep	Pos	# Exposed	1d Survival	2d Survival	3d Survival	4d Survival	5d Survival	6d Survival	7d Survival	Neonates	Male
1104CDCAMGLC	1		1	1	1	1	1	1	1	1	18	0
1104CDCAMGLC	2		1	1	1	1	1	1	1	1	38	0
1104CDCAMGLC	3		1	1	1	1	1	1	1	1	45	0
1104CDCAMGLC	4		1	1	1	1	1	1	1	1	41	0
1104CDCAMGLC	5		1	1	1	1	1	1	1	1	45	0
1104CDCAMGLC	6		1	1	1	1	1	1	1	1	33	0
1104CDCAMGLC	7		1	1	1	1	1	1	1	1	31	0
1104CDCAMGLC	8		1	1	1	1	1	1	1	1	51	0
1104CDCAMGLC	9		1	1	1	1	1	1	1	1	38	0
1104CDCAMGLC	10		1	1	1	1	1	1	1	1	39	0
1104CDCAMGF	1		1	1	1	1	1	1	1	1	49	0
1104CDCAMGF	2		1	1	1	1	1	1	1	1	29	0
1104CDCAMGF	3		1	1	1	1	1	1	1	1	50	0
1104CDCAMGF	4		1	1	1	1	1	1	1	1	39	0
1104CDCAMGF	5		1	1	1	1	1	1	1	1	44	0
1104CDCAMGF	6		1	1	1	1	1	1	1	1	48	0
1104CDCAMGF	7		1	1	1	1	1	1	1	1	53	0
1104CDCAMGF	8		1	1	1	1	1	1	1	1	35	0
1104CDCAMGF	9		1	1	1	1	1	1	1	1	48	0
1104CDCAMGF	10		1	1	1	1	1	1	1	1	54	0
1104CDCAMG6	1		1	1	1	1	1	1	1	1	56	0
1104CDCAMG6	2		1	1	1	1	1	1	1	1	49	0
1104CDCAMG6	3		1	1	1	1	1	1	1	1	24	0
1104CDCAMG6	4		1	1	1	1	1	1	1	1	38	0
1104CDCAMG6	5		1	0	0	0	0	0	0	0	0	0
1104CDCAMG6	6		1	1	1	1	1	1	1	1	48	0
1104CDCAMG6	7		1	1	1	1	1	1	1	1	54	0
1104CDCAMG6	8		1	1	1	1	1	1	1	1	56	0
1104CDCAMG6	9		1	1	1	1	1	1	1	1	53	0
1104CDCAMG6	10		1	1	1	1	1	1	1	1	36	0
1104CDCAMG5	1		1	1	1	1	1	1	1	1	41	0
1104CDCAMG5	2		1	1	1	1	1	1	1	1	29	0
1104CDCAMG5	3		1	1	1	1	1	1	1	1	38	0
1104CDCAMG5	4		1	1	1	1	1	1	1	1	55	0
1104CDCAMG5	5		1	1	1	1	1	1	1	1	37	0
1104CDCAMG5	6		1	1	1	1	1	1	1	1	53	0
1104CDCAMG5	7		1	1	1	1	1	1	1	1	41	0
1104CDCAMG5	8		1	1	1	1	1	1	1	1	56	0
1104CDCAMG5	9		1	1	1	1	1	1	1	1	40	0
1104CDCAMG5	10		1	1	1	1	1	1	1	1	28	0
1104CDCAMG4	1		1	1	1	1	1	1	1	1	51	0
1104CDCAMG4	2		1	1	1	1	1	1	1	1	45	0
1104CDCAMG4	3		1	1	1	1	1	1	1	1	54	0
1104CDCAMG4	4		1	1	1	1	1	1	1	1	59	0
1104CDCAMG4	5		1	1	1	1	1	1	1	1	64	0
1104CDCAMG4	6		1	1	1	1	1	1	1	1	31	0
1104CDCAMG4	7		1	1	1	1	1	1	1	1	48	0
1104CDCAMG4	8		1	1	1	1	1	1	1	1	43	0
1104CDCAMG4	9		1	1	1	1	1	1	1	0	41	0
1104CDCAMG4	10		1	1	1	1	1	1	1	0	40	0
1104CDCAMG3	1		1	1	1	1	1	1	1	1	22	0
1104CDCAMG3	2		1	1	1	1	1	1	1	1	53	0
1104CDCAMG3	3		1	1	1	1	1	1	1	1	55	0

CETIS Data Worksheet

Report Date: 27 Apr-05 10:40 AM
Link: 08-1419-5813/GROVE

Sample Code	Rep	Pos	# Exposed	1d Survival	2d Survival	3d Survival	4d Survival	5d Survival	6d Survival	7d Survival	Neonates	Male
1104CDCAMG3	4		1	1	1	1	1	1	1	1	40	0
1104CDCAMG3	5		1	1	1	1	1	1	1	1	33	0
1104CDCAMG3	6		1	1	1	1	1	1	1	1	57	0
1104CDCAMG3	7		1	1	1	1	1	1	1	1	52	0
1104CDCAMG3	8		1	1	1	1	1	1	1	1	66	0
1104CDCAMG3	9		1	1	1	1	1	1	1	1	55	0
1104CDCAMG3	10		1	1	1	1	1	1	1	1	58	0
1104CDCAMG2	1		1	1	1	1	1	1	1	1	63	0
1104CDCAMG2	2		1	1	1	1	1	1	1	1	48	0
1104CDCAMG2	3		1	1	1	1	1	1	1	1	35	0
1104CDCAMG2	4		1	1	1	1	1	1	0	0	19	0
1104CDCAMG2	5		1	1	1	1	1	1	1	1	45	0
1104CDCAMG2	6		1	1	1	1	1	1	1	0	30	0
1104CDCAMG2	7		1	1	1	1	1	1	1	1	24	0
1104CDCAMG2	8		1	1	1	1	1	1	1	0	34	0
1104CDCAMG2	9		1	1	1	1	1	1	1	1	66	0
1104CDCAMG2	10		1	1	1	1	1	1	1	1	37	0
1104CDCAMG1	1		1	1	1	1	1	1	1	1	46	0
1104CDCAMG1	2		1	1	1	1	1	1	1	1	52	0
1104CDCAMG1	3		1	1	1	1	1	1	1	1	37	0
1104CDCAMG1	4		1	1	1	1	1	1	1	1	0	0
1104CDCAMG1	5		1	1	1	1	1	1	1	1	43	0
1104CDCAMG1	6		1	1	1	1	1	1	1	1	65	0
1104CDCAMG1	7		1	1	1	1	1	1	1	1	61	0
1104CDCAMG1	8		1	1	1	1	1	1	1	1	52	0
1104CDCAMG1	9		1	1	1	1	1	1	1	1	45	0
1104CDCAMG1	10		1	1	1	1	1	1	1	1	57	0

 Analyst:________ Reviewed By:________

CETIS Test Summary

Report Date: 27 Apr-05 10:43 AM
Link: 08-1419-5813/GROVE

Ceriodaphnia 7-d Survival and Reproduction Test					**U.S. EPA Region I Lab**
Test No:	06-4631-4650	**Test Type:**	Reproduction-Survival (7d)	**Duration:**	7d 0h
Start Date:	05 Nov-04	**Protocol:**	EPA/600/4-91/002 (1994)	**Species:**	Ceriodaphnia dubia
Ending Date:	12 Nov-04	**Dil Water:**	None	**Source:**	In-House Culture
Setup Date:	05 Nov-04 12:00 AM	**Brine:**			
Comments:	ESAT Fort Devens Surface Water Chronic Toxicity Test - Grove Pond				

Sample No:	08-2298-7984	**Material:**	Sodium chloride	**Client:**	EPA REGION 1
Sample Date:	05 Nov-04	**Code:**	1104CDCAMG1	**Project:**	
Receive Date:		**Source:**	Fort Devens Grove SW		
Sample Age:	N/A	**Station:**	G1		
Comments:	ESAT Fort Devens Surface Water Chronic Toxicity Test - Grove Pond				
Sample No:	10-0059-0986	**Material:**	Sodium chloride	**Client:**	EPA REGION 1
Sample Date:	05 Nov-04	**Code:**	1104CDCAMG2	**Project:**	
Receive Date:		**Source:**	Fort Devens Grove SW		
Sample Age:	N/A	**Station:**	G2		
Comments:	ESAT Fort Devens Surface Water Chronic Toxicity Test - Grove Pond				
Sample No:	04-9394-9568	**Material:**	Sodium chloride	**Client:**	EPA REGION 1
Sample Date:	05 Nov-04	**Code:**	1104CDCAMG3	**Project:**	
Receive Date:		**Source:**	Fort Devens Grove SW		
Sample Age:	N/A	**Station:**	G3		
Comments:	ESAT Fort Devens Surface Water Chronic Toxicity Test - Grove Pond				
Sample No:	13-5190-6940	**Material:**	Sodium chloride	**Client:**	EPA REGION 1
Sample Date:	05 Nov-04	**Code:**	1104CDCAMG4	**Project:**	
Receive Date:		**Source:**	Fort Devens Grove SW		
Sample Age:	N/A	**Station:**	G4		
Comments:	ESAT Fort Devens Surface Water Chronic Toxicity Test - Grove Pond				
Sample No:	18-9063-6598	**Material:**	Sodium chloride	**Client:**	EPA REGION 1
Sample Date:	05 Nov-04	**Code:**	1104CDCAMG5	**Project:**	
Receive Date:		**Source:**	Fort Devens Grove SW		
Sample Age:	N/A	**Station:**	G5		
Comments:	ESAT Fort Devens Surface Water Chronic Toxicity Test - Grove Pond				
Sample No:	12-2257-7721	**Material:**	Sodium chloride	**Client:**	EPA REGION 1
Sample Date:	05 Nov-04	**Code:**	1104CDCAMG6	**Project:**	
Receive Date:		**Source:**	Fort Devens Grove SW		
Sample Age:	N/A	**Station:**	G6		
Comments:	ESAT Fort Devens Surface Water Chronic Toxicity Test - Grove Pond				
Sample No:	10-5052-4298	**Material:**	Sodium chloride	**Client:**	EPA REGION 1
Sample Date:	05 Nov-04	**Code:**	1104CDCAMGF	**Project:**	
Receive Date:		**Source:**	Fort Devens Grove Flannagan SW		
Sample Age:	N/A	**Station:**	GF1		
Comments:	ESAT Fort Devens Surface Water Chronic Toxicity Test - Grove Pond				
Sample No:	07-5465-1348	**Material:**	Sodium chloride	**Client:**	EPA REGION 1
Sample Date:	05 Nov-04	**Code:**	1104CDCAMGLC	**Project:**	
Receive Date:		**Source:**	Fort Devens Grove LC SW		
Sample Age:	N/A	**Station:**	GLC1		
Comments:	ESAT Fort Devens Surface Water Chronic Toxicity Test - Grove Pond				

CETIS Test Summary

Report Date: 27 Apr-05 10:43 AM
Link: 08-1419-5813/GROVE

7d Proportion Survived Summary

Sample Code	Reps	Mean	Minimum	Maximum	SE	SD	CV
1104CDCAMGLC	10	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
1104CDCAMGF	10	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
1104CDCAMG6	10	0.90000	0.00000	1.00000	0.10000	0.31623	35.14%
1104CDCAMG5	10	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
1104CDCAMG4	10	0.80000	0.00000	1.00000	0.13333	0.42164	52.70%
1104CDCAMG3	10	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
1104CDCAMG2	10	0.70000	0.00000	1.00000	0.15275	0.48305	69.01%
1104CDCAMG1	10	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%

Reproduction Summary

Sample Code	Reps	Mean	Minimum	Maximum	SE	SD	CV
1104CDCAMGLC	10	37.9	18	51	2.88848	9.13418	24.10%
1104CDCAMGF	10	44.9	29	54	2.57531	8.14385	18.14%
1104CDCAMG6	10	41.4	0	56	5.65528	17.8836	43.20%
1104CDCAMG5	10	41.8	28	56	3.15806	9.98666	23.89%
1104CDCAMG4	10	47.6	31	64	3.08473	9.75477	20.49%
1104CDCAMG3	10	49.1	22	66	4.21228	13.3204	27.13%
1104CDCAMG2	10	40.1	19	66	4.9	15.4952	38.64%
1104CDCAMG1	10	45.8	0	65	5.75963	18.2135	39.77%

7d Proportion Survived Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
1104CDCAMGLC	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
1104CDCAMGF	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
1104CDCAMG6	1.00000	1.00000	1.00000	1.00000	0.00000	1.00000	1.00000	1.00000	1.00000	1.00000
1104CDCAMG5	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
1104CDCAMG4	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	0.00000	0.00000
1104CDCAMG3	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
1104CDCAMG2	1.00000	1.00000	1.00000	0.00000	1.00000	0.00000	1.00000	0.00000	1.00000	1.00000
1104CDCAMG1	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

Reproduction Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
1104CDCAMGLC	18	38	45	41	45	33	31	51	38	39
1104CDCAMGF	49	29	50	39	44	48	53	35	48	54
1104CDCAMG6	56	49	24	38	0	48	54	56	53	36
1104CDCAMG5	41	29	38	55	37	53	41	56	40	28
1104CDCAMG4	51	45	54	59	64	31	48	43	41	40
1104CDCAMG3	22	53	55	40	33	57	52	66	55	58
1104CDCAMG2	63	48	35	19	45	30	24	34	66	37
1104CDCAMG1	46	52	37	0	43	65	61	52	45	57

CETIS Analysis Detail

Ceriodaphnia 7-d Survival and Reproduction Test	U.S. EPA Region I Lab

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
7d Proportion Survived	Comparison	08-1419-5813	08-1419-5813	15 Mar-05 10:33 AM	CETISv1.025

Method	Alt H	Data Transform
Fisher's Exact	C > T	Untransformed

NOEL	LOEL	Toxic Units	ChV	MSDp
		N/A		

Group Comparisons

Sample	vs Sample	Statistic	Critical	Decision(0.05)
1104CDCAMG	1104CDCAMG	1.00000	0.05000	Non-Significant Effect
1104CDCAMG	1104CDCAMG	0.50000	0.05000	Non-Significant Effect
1104CDCAMG	1104CDCAMG	1.00000	0.05000	Non-Significant Effect
1104CDCAMG	1104CDCAMG	0.23684	0.05000	Non-Significant Effect
1104CDCAMG	1104CDCAMG	1.00000	0.05000	Non-Significant Effect
1104CDCAMG	1104CDCAMG	0.10526	0.05000	Non-Significant Effect
1104CDCAMG	1104CDCAMG	1.00000	0.05000	Non-Significant Effect

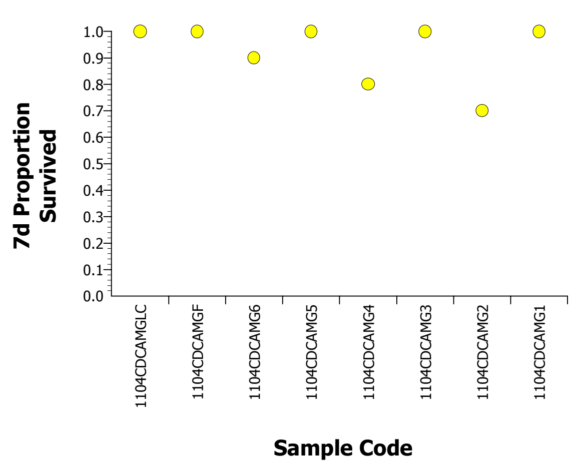
Data Summary

Sample Code	Non-Responders	Responders	Total Observed
1104CDCAMG	10	0	10
1104CDCAMG	10	0	10
1104CDCAMG	9	1	10
1104CDCAMG	10	0	10
1104CDCAMG	8	2	10
1104CDCAMG	10	0	10
1104CDCAMG	7	3	10
1104CDCAMG	10	0	10

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
1104CDCAMGLC	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
1104CDCAMGF	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
1104CDCAMG6	1.00000	1.00000	1.00000	1.00000	0.00000	1.00000	1.00000	1.00000	1.00000	1.00000
1104CDCAMG5	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
1104CDCAMG4	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	0.00000	0.00000
1104CDCAMG3	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
1104CDCAMG2	1.00000	1.00000	1.00000	0.00000	1.00000	0.00000	1.00000	0.00000	1.00000	1.00000
1104CDCAMG1	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

Graphics



CETIS Analysis Detail

Ceriodaphnia 7-d Survival and Reproduction Test **U.S. EPA Region I Lab**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
7d Proportion Survived	Comparison	08-1419-5813	08-1419-5813	23 Mar-05 11:27 AM	CETISv1.025

Method	Alt H	Data Transform
Fisher's Exact	C > T	Untransformed

NOEL	LOEL	Toxic Units	ChV	MSDp
		N/A		

Group Comparisons

Sample	vs Sample	Statistic	Critical	Decision(0.05)
1104CDCAMG	1104CDCAMG	0.50000	0.05000	Non-Significant Effect
1104CDCAMG	1104CDCAMG	1.00000	0.05000	Non-Significant Effect
1104CDCAMG	1104CDCAMG	0.23684	0.05000	Non-Significant Effect
1104CDCAMG	1104CDCAMG	1.00000	0.05000	Non-Significant Effect
1104CDCAMG	1104CDCAMG	0.10526	0.05000	Non-Significant Effect
1104CDCAMG	1104CDCAMG	1.00000	0.05000	Non-Significant Effect

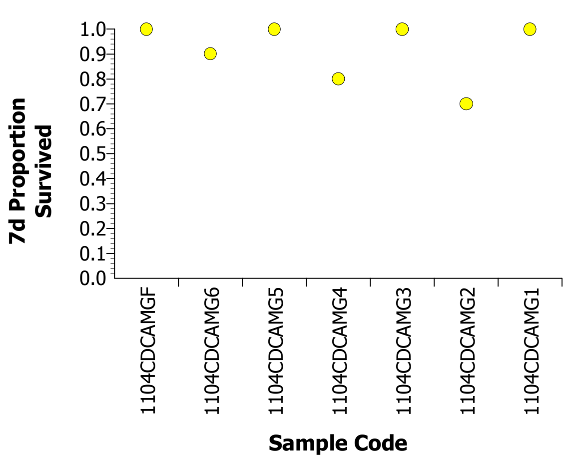
Data Summary

Sample Code	Non-Responders	Responders	Total Observed
1104CDCAMG	10	0	10
1104CDCAMG	9	1	10
1104CDCAMG	10	0	10
1104CDCAMG	8	2	10
1104CDCAMG	10	0	10
1104CDCAMG	7	3	10
1104CDCAMG	10	0	10

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
1104CDCAMGF	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
1104CDCAMG6	1.00000	1.00000	1.00000	1.00000	0.00000	1.00000	1.00000	1.00000	1.00000	1.00000
1104CDCAMG5	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
1104CDCAMG4	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	0.00000	0.00000
1104CDCAMG3	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
1104CDCAMG2	1.00000	1.00000	1.00000	0.00000	1.00000	0.00000	1.00000	0.00000	1.00000	1.00000
1104CDCAMG1	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

Graphics



Report Date: 27 Apr-05 11:00 AM
Analysis: 10-7712-6407/GROVE

CETIS Analysis Detail

Ceriodaphnia 7-d Survival and Reproduction Test — **U.S. EPA Region I Lab**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Reproduction	Comparison	08-1419-5813	08-1419-5813	15 Mar-05 10:34 AM	CETISv1.025

Method	Alt H	Data Transform	Z
Dunnett's Multiple Comparison	C > T	Untransformed	

NOEL	LOEL	Toxic Units	ChV	MSDp
		N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Bartlett	11.99274	18.47531	0.10080	Equal Variances
Distribution	Kolmogorov-Smirnov D	0.08082	0.11566	0.20571	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	1055.95	150.85	7	0.85	0.54720	Non-Significant Effect
Error	12723.6	176.7167	72			
Total	13779.5496	327.56667	79			

Group Comparisons

Sample vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
1104CDCAMGL	1104CDCAMGF	-1.1775	2.38333	> 0.0500	14.169	Non-Significant Effect
1104CDCAMGL	1104CDCAMG6	-0.5887	2.38333	> 0.0500	14.169	Non-Significant Effect
1104CDCAMGL	1104CDCAMG5	-0.6560	2.38333	> 0.0500	14.169	Non-Significant Effect
1104CDCAMGL	1104CDCAMG4	-1.6316	2.38333	> 0.0500	14.169	Non-Significant Effect
1104CDCAMGL	1104CDCAMG3	-1.8839	2.38333	> 0.0500	14.169	Non-Significant Effect
1104CDCAMGL	1104CDCAMG2	-0.3701	2.38333	> 0.0500	14.169	Non-Significant Effect
1104CDCAMGL	1104CDCAMG1	-1.3288	2.38333	> 0.0500	14.169	Non-Significant Effect

Data Summary

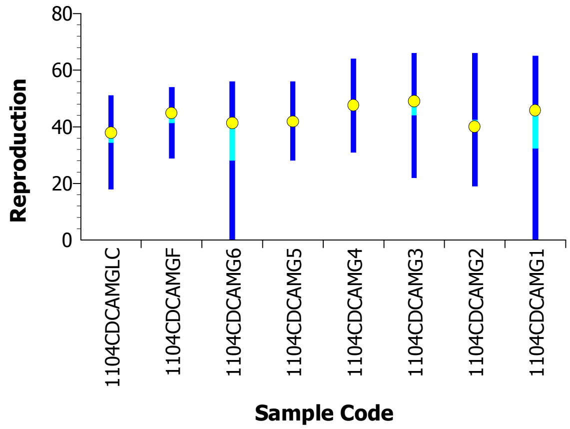
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
1104CDCAMGLC	10	37.9	18	51	9.13418				
1104CDCAMGF	10	44.9	29	54	8.14385				
1104CDCAMG6	10	41.4	0	56	17.8836				
1104CDCAMG5	10	41.8	28	56	9.98666				
1104CDCAMG4	10	47.6	31	64	9.75477				
1104CDCAMG3	10	49.1	22	66	13.3204				
1104CDCAMG2	10	40.1	19	66	15.4952				
1104CDCAMG1	10	45.8	0	65	18.2135				

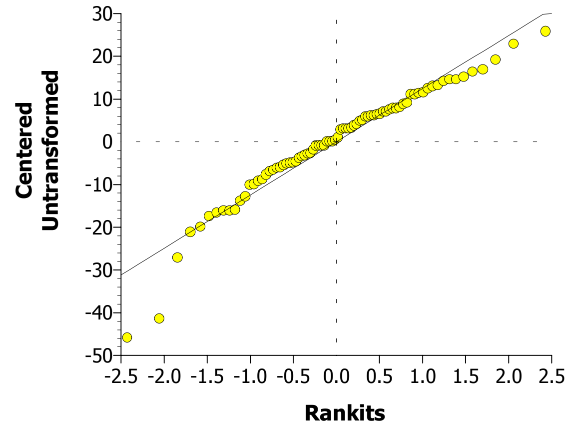
Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
1104CDCAMGLC	18	38	45	41	45	33	31	51	38	39
1104CDCAMGF	49	29	50	39	44	48	53	35	48	54
1104CDCAMG6	56	49	24	38	0	48	54	56	53	36
1104CDCAMG5	41	29	38	55	37	53	41	56	40	28
1104CDCAMG4	51	45	54	59	64	31	48	43	41	40
1104CDCAMG3	22	53	55	40	33	57	52	66	55	58
1104CDCAMG2	63	48	35	19	45	30	24	34	66	37
1104CDCAMG1	46	52	37	0	43	65	61	52	45	57

CETIS Analysis Detail

Graphics





Report Date: 27 Apr-05 11:04 AM
Analysis: 02-6565-3198/GROVE

CETIS Analysis Detail

Ceriodaphnia 7-d Survival and Reproduction Test — **U.S. EPA Region I Lab**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Reproduction	Comparison	08-1419-5813	08-1419-5813	23 Mar-05 11:28 AM	CETISv1.025

Method	Alt H	Data Transform	Z
Dunnett's Multiple Comparison	C > T	Untransformed	

NOEL	LOEL	Toxic Units	ChV	MSDp
		N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Bartlett	9.89915	16.81190	0.12896	Equal Variances
Distribution	Kolmogorov-Smirnov D	0.08712	0.12346	0.19613	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	687.8857	114.6476	6	0.60	0.72666	Non-Significant Effect
Error	11972.7	190.0429	63			
Total	12660.5859	304.69048	69			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
1104CDCAMGF		1104CDCAMG6	0.56771	2.34714	> 0.0500	14.4704	Non-Significant Effect
1104CDCAMGF		1104CDCAMG5	0.50283	2.34714	> 0.0500	14.4704	Non-Significant Effect
1104CDCAMGF		1104CDCAMG4	-0.4379	2.34714	> 0.0500	14.4704	Non-Significant Effect
1104CDCAMGF		1104CDCAMG3	-0.6813	2.34714	> 0.0500	14.4704	Non-Significant Effect
1104CDCAMGF		1104CDCAMG2	0.77858	2.34714	> 0.0500	14.4704	Non-Significant Effect
1104CDCAMGF		1104CDCAMG1	-0.146	2.34714	> 0.0500	14.4704	Non-Significant Effect

Data Summary

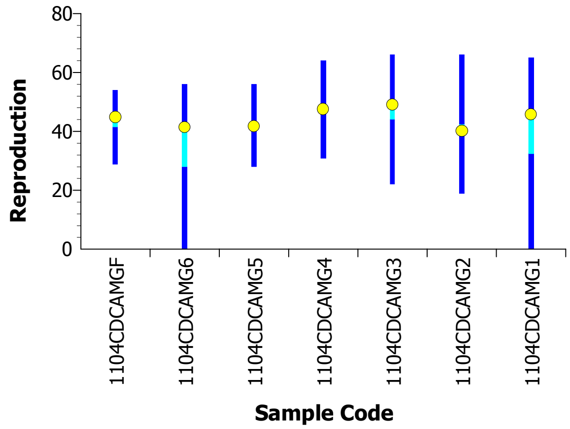
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
1104CDCAMGF	10	44.9	29	54	8.14385				
1104CDCAMG6	10	41.4	0	56	17.8836				
1104CDCAMG5	10	41.8	28	56	9.98666				
1104CDCAMG4	10	47.6	31	64	9.75477				
1104CDCAMG3	10	49.1	22	66	13.3204				
1104CDCAMG2	10	40.1	19	66	15.4952				
1104CDCAMG1	10	45.8	0	65	18.2135				

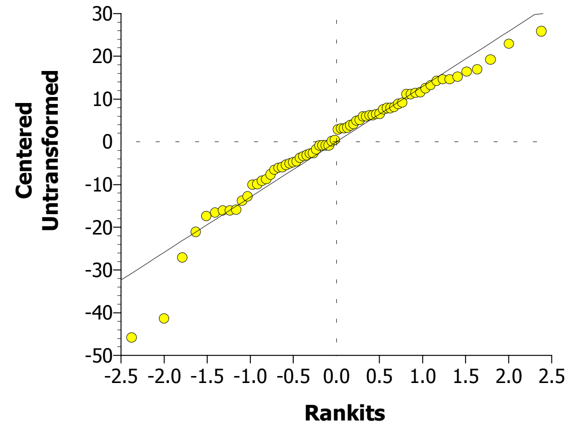
Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
1104CDCAMGF	49	29	50	39	44	48	53	35	48	54
1104CDCAMG6	56	49	24	38	0	48	54	56	53	36
1104CDCAMG5	41	29	38	55	37	53	41	56	40	28
1104CDCAMG4	51	45	54	59	64	31	48	43	41	40
1104CDCAMG3	22	53	55	40	33	57	52	66	55	58
1104CDCAMG2	63	48	35	19	45	30	24	34	66	37
1104CDCAMG1	46	52	37	0	43	65	61	52	45	57

CETIS Analysis Detail

Graphics





CETIS Data Worksheet

Report Date: 27 Apr-05 11:13 AM
Link: 05-9078-7061/PLOW SHOP

Ceriodaphnia 7-d Survival and Reproduction Test **U.S. EPA Region I Lab**

Start Date: 05 Nov-04 **Species:** Ceriodaphnia dubia **Sample Code:** 1104CDCAMPSLC
Ending Date: 12 Nov-04 **Protocol:** EPA/600/4-91/002 (1994) **Sample Source:** Fort Devens Plow Shop LC SW
Sample Date: 05 Nov-04 **Material:** Sodium chloride **Sample Station:** PSLC

Sample Code	Rep	Pos	# Exposed	1d Survival	2d Survival	3d Survival	4d Survival	5d Survival	6d Survival	7d Survival	Neonates	Male
1104CDCAMPSLC	1		1	1	1	1	1	1	1	0	36	0
1104CDCAMPSLC	2		1	1	1	1	1	1	1	1	42	0
1104CDCAMPSLC	3		1	1	1	1	1	1	1	1	44	0
1104CDCAMPSLC	4		1	1	1	1	1	1	1	1	33	0
1104CDCAMPSLC	5		1	1	1	1	1	1	1	1	46	0
1104CDCAMPSLC	6		1	1	1	1	1	1	0	0	16	0
1104CDCAMPSLC	7		1	1	1	1	1	1	0	0	6	0
1104CDCAMPSLC	8		1	1	1	1	0	0	0	0	0	0
1104CDCAMPSLC	9		1	1	1	1	1	1	1	1	16	0
1104CDCAMPSLC	10		1	1	1	1	1	1	1	1	40	0
1104CDCAMPSF	1		1	1	1	1	1	1	1	1	56	0
1104CDCAMPSF	2		1	1	1	1	1	1	1	1	41	0
1104CDCAMPSF	3		1	1	1	1	1	1	1	1	41	0
1104CDCAMPSF	4		1	1	1	1	1	1	1	1	55	0
1104CDCAMPSF	5		1	1	1	1	1	1	1	1	51	0
1104CDCAMPSF	6		1	1	1	1	1	1	1	1	54	0
1104CDCAMPSF	7		1	1	1	1	1	1	1	1	42	0
1104CDCAMPSF	8		1	1	1	1	1	1	1	1	9	0
1104CDCAMPSF	9		1	1	1	1	1	1	1	1	53	0
1104CDCAMPSF	10		1	1	1	1	1	1	1	1	25	0
1104CDCAMPS1	1		1	1	1	1	1	1	1	1	49	0
1104CDCAMPS1	2		1	1	1	1	1	1	1	1	46	0
1104CDCAMPS1	3		1	1	1	1	1	1	1	1	52	0
1104CDCAMPS1	4		1	1	1	1	1	0	0	0	16	0
1104CDCAMPS1	5		1	1	1	1	1	1	1	1	49	0
1104CDCAMPS1	6		1	1	1	1	1	1	1	1	61	0
1104CDCAMPS1	7		1	1	1	1	1	1	1	1	56	0
1104CDCAMPS1	8		1	1	1	1	1	1	1	1	56	0
1104CDCAMPS1	9		1	1	1	1	1	1	1	1	64	0
1104CDCAMPS1	10		1	1	1	1	1	1	1	1	50	0
1104CDCAMPS2	1		1	1	1	1	1	1	1	1	38	0
1104CDCAMPS2	2		1	1	1	1	1	1	1	1	30	0
1104CDCAMPS2	3		1	1	1	1	1	1	1	1	49	0
1104CDCAMPS2	4		1	1	1	1	1	1	1	1	49	0
1104CDCAMPS2	5		1	1	1	1	1	1	1	1	53	0
1104CDCAMPS2	6		1	1	1	1	1	1	1	1	39	0
1104CDCAMPS2	7		1	1	1	1	1	1	1	1	45	0
1104CDCAMPS2	8		1	1	1	1	1	1	1	1	51	0
1104CDCAMPS2	9		1	1	1	1	1	1	1	0	56	0
1104CDCAMPS2	10		1	1	1	1	1	1	1	1	56	0
1104CDCAMPS3	1		1	1	1	1	1	1	1	1	59	0
1104CDCAMPS3	2		1	1	1	1	1	1	1	1	49	0
1104CDCAMPS3	3		1	1	1	1	1	1	1	1	50	0
1104CDCAMPS3	4		1	1	1	1	1	1	1	1	52	0
1104CDCAMPS3	5		1	1	1	1	1	1	1	1	45	0
1104CDCAMPS3	6		1	1	1	1	1	1	1	1	49	0
1104CDCAMPS3	7		1	1	1	1	1	1	1	1	48	0
1104CDCAMPS3	8		1	1	1	1	1	1	1	1	55	0
1104CDCAMPS3	9		1	1	1	1	1	1	1	1	55	0
1104CDCAMPS3	10		1	1	1	1	1	1	1	1	39	0
1104CDCAMPS4	1		1	1	1	1	1	1	1	1	57	0
1104CDCAMPS4	2		1	1	1	1	1	1	1	1	8	0
1104CDCAMPS4	3		1	1	1	1	0	0	0	0	3	0

 Analyst:________ Reviewed By:________

CETIS Data Worksheet

Report Date: 27 Apr-05 11:13 AM
Link: 05-9078-7061/PLOW SHOP

Sample Code	Rep	Pos	# Exposed	1d Survival	2d Survival	3d Survival	4d Survival	5d Survival	6d Survival	7d Survival	Neonates	Male
1104CDCAMPS4	4		1	1	1	1	1	1	1	1	39	0
1104CDCAMPS4	5		1	1	1	1	1	1	1	1	43	0
1104CDCAMPS4	6		1	1	1	1	1	1	1	1	57	0
1104CDCAMPS4	7		1	1	1	1	1	1	1	1	31	0
1104CDCAMPS4	8		1	1	1	1	1	1	1	1	40	0
1104CDCAMPS4	9		1	1	1	1	1	1	1	1	32	0
1104CDCAMPS4	10		1	1	1	1	0	0	0	0	1	0
1104CDCAMPS5	1		1	1	1	1	1	1	1	1	59	0
1104CDCAMPS5	2		1	1	1	1	1	1	1	1	34	0
1104CDCAMPS5	3		1	1	1	1	1	1	1	1	33	0
1104CDCAMPS5	4		1	1	1	1	1	1	1	1	64	0
1104CDCAMPS5	5		1	1	1	1	1	1	1	1	49	0
1104CDCAMPS5	6		1	1	1	1	1	1	1	1	12	0
1104CDCAMPS5	7		1	1	1	1	1	1	1	1	59	0
1104CDCAMPS5	8		1	1	1	1	1	0	0	0	13	0
1104CDCAMPS5	9		1	1	1	1	1	1	1	1	44	0
1104CDCAMPS5	10		1	1	1	1	1	1	1	1	12	0
1104CDCAMPS6	1		1	1	1	1	1	1	1	1	36	0
1104CDCAMPS6	2		1	1	1	1	1	1	1	1	52	0
1104CDCAMPS6	3		1	1	1	1	1	1	1	1	54	0
1104CDCAMPS6	4		1	1	1	1	1	1	1	1	44	0
1104CDCAMPS6	5		1	1	1	1	1	1	1	1	27	0
1104CDCAMPS6	6		1	1	1	1	1	1	1	1	61	0
1104CDCAMPS6	7		1	1	1	1	1	1	1	1	62	0
1104CDCAMPS6	8		1	1	1	1	1	1	1	1	55	0
1104CDCAMPS6	9		1	1	1	1	1	1	1	1	51	0
1104CDCAMPS6	10		1	1	1	1	1	1	1	1	37	0

CETIS Test Summary

Report Date: 27 Apr-05 11:16 AM
Link: 05-9078-7061/PLOW SHOP

Ceriodaphnia 7-d Survival and Reproduction Test					**U.S. EPA Region I Lab**
Test No:	01-8642-5606	**Test Type:**	Reproduction-Survival (7d)	**Duration:**	7d 0h
Start Date:	05 Nov-04	**Protocol:**	EPA/600/4-91/002 (1994)	**Species:**	Ceriodaphnia dubia
Ending Date:	12 Nov-04	**Dil Water:**	None	**Source:**	In-House Culture
Setup Date:	05 Nov-04 12:00 AM	**Brine:**			
Comments:	ESAT Fort Devens Surface Water Chronic Toxicity Test - Plow Shop Pond				

Sample No:	06-5848-3458	**Material:**	Sodium chloride	**Client:**	EPA REGION 1
Sample Date:	05 Nov-04	**Code:**	1104CDCAMPS1	**Project:**	
Receive Date:		**Source:**	Fort Devens Plow Shop SW		
Sample Age:	N/A	**Station:**	PS1		
Comments:	ESAT Fort Devens Surface Water Chronic Toxicity Test - Plow Shop Pond				
Sample No:	06-7474-6028	**Material:**	Sodium chloride	**Client:**	EPA REGION 1
Sample Date:	05 Nov-04	**Code:**	1104CDCAMPS2	**Project:**	
Receive Date:		**Source:**	Fort Devens Plow Shop SW		
Sample Age:	N/A	**Station:**	PS2		
Comments:	ESAT Fort Devens Surface Water Chronic Toxicity Test - Plow Shop Pond				
Sample No:	09-7925-9953	**Material:**	Sodium chloride	**Client:**	EPA REGION 1
Sample Date:	05 Nov-04	**Code:**	1104CDCAMPS3	**Project:**	
Receive Date:		**Source:**	Fort Devens Plow Shop SW		
Sample Age:	N/A	**Station:**	PS3		
Comments:	ESAT Fort Devens Surface Water Chronic Toxicity Test - Plow Shop Pond				
Sample No:	05-5116-7730	**Material:**	Sodium chloride	**Client:**	EPA REGION 1
Sample Date:	05 Nov-04	**Code:**	1104CDCAMPS4	**Project:**	
Receive Date:		**Source:**	Fort Devens Plow Shop SW		
Sample Age:	N/A	**Station:**	PS4		
Comments:	ESAT Fort Devens Surface Water Chronic Toxicity Test - Plow Shop Pond				
Sample No:	05-8763-2797	**Material:**	Sodium chloride	**Client:**	EPA REGION 1
Sample Date:	05 Nov-04	**Code:**	1104CDCAMPS5	**Project:**	
Receive Date:		**Source:**	Fort Devens Plow Shop SW		
Sample Age:	N/A	**Station:**	PS5		
Comments:	ESAT Fort Devens Surface Water Chronic Toxicity Test - Plow Shop Pond				
Sample No:	11-8745-3528	**Material:**	Sodium chloride	**Client:**	EPA REGION 1
Sample Date:	05 Nov-04	**Code:**	1104CDCAMPS6	**Project:**	
Receive Date:		**Source:**	Fort Devens Plow Shop SW		
Sample Age:	N/A	**Station:**	PS6		
Comments:	ESAT Fort Devens Surface Water Chronic Toxicity Test - Plow Shop Pond				
Sample No:	06-7405-7801	**Material:**	Sodium chloride	**Client:**	EPA REGION 1
Sample Date:	05 Nov-04	**Code:**	1104CDCAMPSF	**Project:**	
Receive Date:		**Source:**	Fort Devens Plow Shop Flannagan S		
Sample Age:	N/A	**Station:**	PSF		
Comments:	ESAT Fort Devens Surface Water Chronic Toxicity Test - Plow Shop Pond				
Sample No:	01-1845-3466	**Material:**	Sodium chloride	**Client:**	EPA REGION 1
Sample Date:	05 Nov-04	**Code:**	1104CDCAMPSLC	**Project:**	
Receive Date:		**Source:**	Fort Devens Plow Shop LC SW		
Sample Age:	N/A	**Station:**	PSLC		
Comments:	ESAT Fort Devens Surface Water Chronic Toxicity Test - Plow Shop Pond				

CETIS Test Summary

Report Date: 27 Apr-05 11:16 AM
Link: 05-9078-7061/PLOW SHOP

7d Proportion Survived Summary

Sample Code	Reps	Mean	Minimum	Maximum	SE	SD	CV
1104CDCAMPSLC	10	0.60000	0.00000	1.00000	0.16330	0.51640	86.07%
1104CDCAMPSF	10	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
1104CDCAMPS1	10	0.90000	0.00000	1.00000	0.10000	0.31623	35.14%
1104CDCAMPS2	10	0.90000	0.00000	1.00000	0.10000	0.31623	35.14%
1104CDCAMPS3	10	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
1104CDCAMPS4	10	0.80000	0.00000	1.00000	0.13333	0.42164	52.70%
1104CDCAMPS5	10	0.90000	0.00000	1.00000	0.10000	0.31623	35.14%
1104CDCAMPS6	10	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%

Reproduction Summary

Sample Code	Reps	Mean	Minimum	Maximum	SE	SD	CV
1104CDCAMPSLC	10	27.9	0	46	5.33844	16.8816	60.51%
1104CDCAMPSF	10	42.7	9	56	4.81445	15.2246	35.65%
1104CDCAMPS1	10	49.9	16	64	4.17253	13.1947	26.44%
1104CDCAMPS2	10	46.6	30	56	2.70473	8.55310	18.35%
1104CDCAMPS3	10	50.1	39	59	1.78543	5.64604	11.27%
1104CDCAMPS4	10	31.1	1	57	6.54463	20.6959	66.55%
1104CDCAMPS5	10	37.9	12	64	6.44024	20.3658	53.74%
1104CDCAMPS6	10	47.9	27	62	3.64676	11.5321	24.08%

7d Proportion Survived Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
1104CDCAMPSLC	0.00000	1.00000	1.00000	1.00000	1.00000	0.00000	0.00000	0.00000	1.00000	1.00000
1104CDCAMPSF	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
1104CDCAMPS1	1.00000	1.00000	1.00000	0.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
1104CDCAMPS2	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	0.00000	1.00000
1104CDCAMPS3	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
1104CDCAMPS4	1.00000	1.00000	0.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	0.00000
1104CDCAMPS5	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	0.00000	1.00000	1.00000
1104CDCAMPS6	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

Reproduction Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
1104CDCAMPSLC	36	42	44	33	46	16	6	0	16	40
1104CDCAMPSF	56	41	41	55	51	54	42	9	53	25
1104CDCAMPS1	49	46	52	16	49	61	56	56	64	50
1104CDCAMPS2	38	30	49	49	53	39	45	51	56	56
1104CDCAMPS3	59	49	50	52	45	49	48	55	55	39
1104CDCAMPS4	57	8	3	39	43	57	31	40	32	1
1104CDCAMPS5	59	34	33	64	49	12	59	13	44	12
1104CDCAMPS6	36	52	54	44	27	61	62	55	51	37

Report Date: 27 Apr-05 11:23 AM

Analysis: 07-8676-6891/PLOW SHOP

CETIS Analysis Detail

Ceriodaphnia 7-d Survival and Reproduction Test — **U.S. EPA Region I Lab**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
7d Proportion Survived	Comparison	05-9078-7061	05-9078-7061	27 Apr-05 11:22 AM	CETISv1.025

Method	Alt H	Data Transform
Fisher's Exact	C > T	Untransformed

NOEL	LOEL	Toxic Units	ChV	MSDp
		N/A		

Group Comparisons

Sample vs	Sample	Statistic	Critical	Decision(0.05)
1104CDCAMP	1104CDCAMP	1.00000	0.05000	Non-Significant Effect
1104CDCAMP	1104CDCAMP	1.00000	0.05000	Non-Significant Effect
1104CDCAMP	1104CDCAMP	1.00000	0.05000	Non-Significant Effect
1104CDCAMP	1104CDCAMP	1.00000	0.05000	Non-Significant Effect
1104CDCAMP	1104CDCAMP	1.00000	0.05000	Non-Significant Effect
1104CDCAMP	1104CDCAMP	1.00000	0.05000	Non-Significant Effect
1104CDCAMP	1104CDCAMP	1.00000	0.05000	Non-Significant Effect

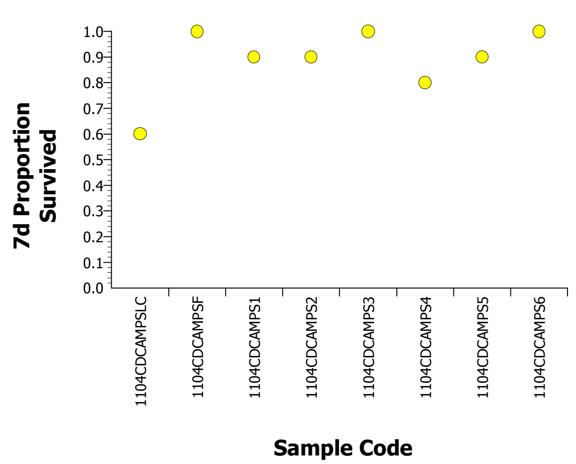
Data Summary

Sample Code	Non-Responders	Responders	Total Observed
1104CDCAMP	6	4	10
1104CDCAMP	10	0	10
1104CDCAMP	9	1	10
1104CDCAMP	9	1	10
1104CDCAMP	10	0	10
1104CDCAMP	8	2	10
1104CDCAMP	9	1	10
1104CDCAMP	10	0	10

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
1104CDCAMPSLC	0.00000	1.00000	1.00000	1.00000	1.00000	0.00000	0.00000	0.00000	1.00000	1.00000
1104CDCAMPSF	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
1104CDCAMPS1	1.00000	1.00000	1.00000	0.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
1104CDCAMPS2	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	0.00000	1.00000
1104CDCAMPS3	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
1104CDCAMPS4	1.00000	1.00000	0.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	0.00000
1104CDCAMPS5	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	0.00000	1.00000	1.00000
1104CDCAMPS6	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

Graphics



CETIS Analysis Detail

Ceriodaphnia 7-d Survival and Reproduction Test — **U.S. EPA Region I Lab**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
7d Proportion Survived	Comparison	05-9078-7061	05-9078-7061	23 Mar-05 11:30 AM	CETISv1.025

Method	Alt H	Data Transform
Fisher's Exact	C > T	Untransformed

NOEL	LOEL	Toxic Units	ChV	MSDp
		N/A		

Group Comparisons

Sample vs	Sample	Statistic	Critical	Decision(0.05)
1104CDCAMP	1104CDCAMP	0.50000	0.05000	Non-Significant Effect
1104CDCAMP	1104CDCAMP	0.50000	0.05000	Non-Significant Effect
1104CDCAMP	1104CDCAMP	1.00000	0.05000	Non-Significant Effect
1104CDCAMP	1104CDCAMP	0.23684	0.05000	Non-Significant Effect
1104CDCAMP	1104CDCAMP	0.50000	0.05000	Non-Significant Effect
1104CDCAMP	1104CDCAMP	1.00000	0.05000	Non-Significant Effect

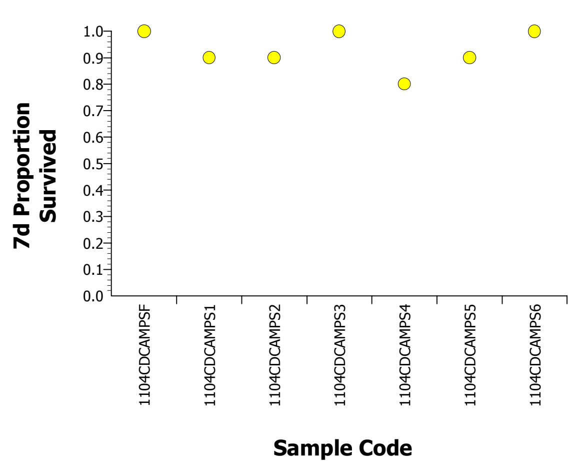
Data Summary

Sample Code	Non-Responders	Responders	Total Observed
1104CDCAMP	10	0	10
1104CDCAMP	9	1	10
1104CDCAMP	9	1	10
1104CDCAMP	10	0	10
1104CDCAMP	8	2	10
1104CDCAMP	9	1	10
1104CDCAMP	10	0	10

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
1104CDCAMPSF	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
1104CDCAMPS1	1.00000	1.00000	1.00000	0.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
1104CDCAMPS2	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	0.00000	1.00000
1104CDCAMPS3	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
1104CDCAMPS4	1.00000	1.00000	0.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	0.00000
1104CDCAMPS5	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	0.00000	1.00000	1.00000
1104CDCAMPS6	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

Graphics



CETIS Analysis Detail

Ceriodaphnia 7-d Survival and Reproduction Test — **U.S. EPA Region I Lab**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Reproduction	Comparison	05-9078-7061	05-9078-7061	23 Mar-05 11:33 AM	CETISv1.025

Method	Alt H	Data Transform	Z
Steel's Many-One Rank	C > T	Untransformed	

NOEL	LOEL	Toxic Units	ChV	MSDp
		N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Bartlett	19.12091	18.47531	0.00782	Unequal Variances
Distribution	Kolmogorov-Smirnov D	0.12875	0.11566	0.00223	Non-normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	5184.587	740.6553	7	3.34	0.00385	Significant Effect
Error	15947.9	221.4986	72			
Total	21132.4878	962.15395	79			

Group Comparisons

Sample vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
1104CDCAMPS	1104CDCAMPS	132.5	74	> 0.0500	3	Non-Significant Effect
1104CDCAMPS	1104CDCAMPS	147.5	74	> 0.0500	4	Non-Significant Effect
1104CDCAMPS	1104CDCAMPS	140	74	> 0.0500	3	Non-Significant Effect
1104CDCAMPS	1104CDCAMPS	150	74	> 0.0500	3	Non-Significant Effect
1104CDCAMPS	1104CDCAMPS	107.5	74	> 0.0500	3	Non-Significant Effect
1104CDCAMPS	1104CDCAMPS	119	74	> 0.0500	5	Non-Significant Effect
1104CDCAMPS	1104CDCAMPS	139	74	> 0.0500	3	Non-Significant Effect

Data Summary

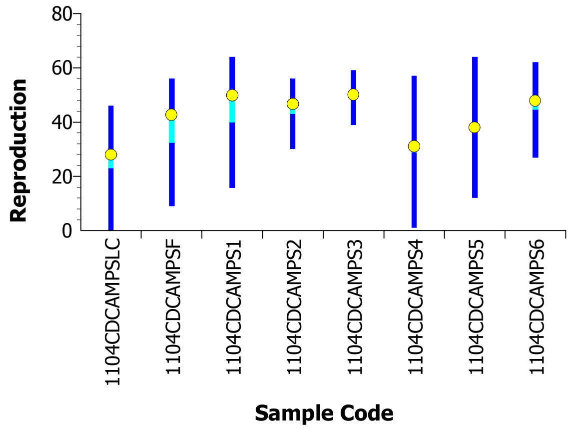
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
1104CDCAMPSLC	10	27.9	0	46	16.8816				
1104CDCAMPSF	10	42.7	9	56	15.2246				
1104CDCAMPS1	10	49.9	16	64	13.1947				
1104CDCAMPS2	10	46.6	30	56	8.55310				
1104CDCAMPS3	10	50.1	39	59	5.64604				
1104CDCAMPS4	10	31.1	1	57	20.6959				
1104CDCAMPS5	10	37.9	12	64	20.3658				
1104CDCAMPS6	10	47.9	27	62	11.5321				

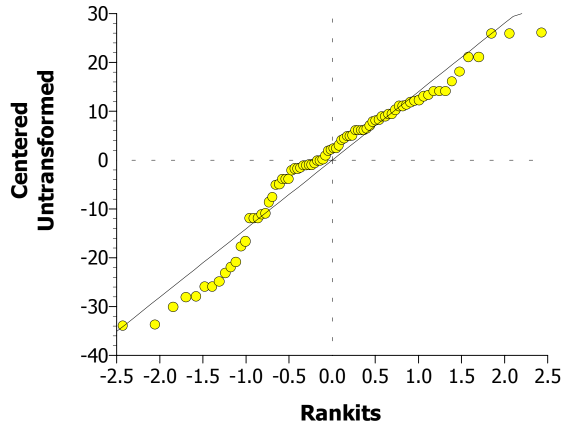
Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
1104CDCAMPSLC	36	42	44	33	46	16	6	0	16	40
1104CDCAMPSF	56	41	41	55	51	54	42	9	53	25
1104CDCAMPS1	49	46	52	16	49	61	56	56	64	50
1104CDCAMPS2	38	30	49	49	53	39	45	51	56	56
1104CDCAMPS3	59	49	50	52	45	49	48	55	55	39
1104CDCAMPS4	57	8	3	39	43	57	31	40	32	1
1104CDCAMPS5	59	34	33	64	49	12	59	13	44	12
1104CDCAMPS6	36	52	54	44	27	61	62	55	51	37

CETIS Analysis Detail

Graphics





CETIS Analysis Detail

Ceriodaphnia 7-d Survival and Reproduction Test	U.S. EPA Region I Lab

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Reproduction	Comparison	05-9078-7061	05-9078-7061	23 Mar-05 11:30 AM	CETISv1.025

Method	Alt H	Data Transform	Z
Steel's Many-One Rank	C > T	Untransformed	

NOEL	LOEL	Toxic Units	ChV	MSDp
		N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Bartlett	18.75788	16.81190	0.00459	Unequal Variances
Distribution	Kolmogorov-Smirnov D	0.14007	0.12346	0.00164	Non-normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	2988.371	498.0619	6	2.34	0.04163	Significant Effect
Error	13383	212.4286	63			
Total	16371.3713	710.49046	69			

Group Comparisons

Sample vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
1104CDCAMPS	1104CDCAMPS	121	74	> 0.0500	3	Non-Significant Effect
1104CDCAMPS	1104CDCAMPS	107	74	> 0.0500	5	Non-Significant Effect
1104CDCAMPS	1104CDCAMPS	115	74	> 0.0500	3	Non-Significant Effect
1104CDCAMPS	1104CDCAMPS	88	74	> 0.0500	2	Non-Significant Effect
1104CDCAMPS	1104CDCAMPS	102	74	> 0.0500	3	Non-Significant Effect
1104CDCAMPS	1104CDCAMPS	113.5	74	> 0.0500	4	Non-Significant Effect

Data Summary

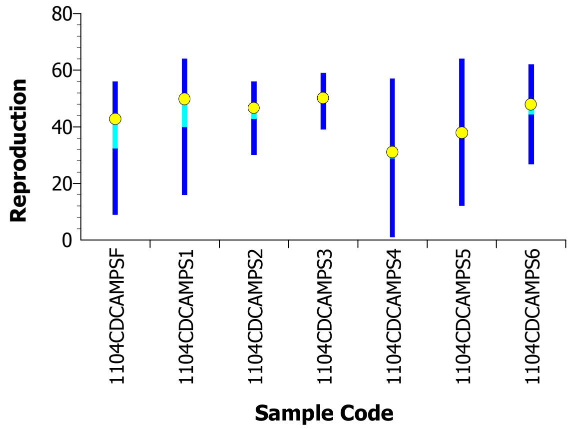
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
1104CDCAMPSF	10	42.7	9	56	15.2246				
1104CDCAMPS1	10	49.9	16	64	13.1947				
1104CDCAMPS2	10	46.6	30	56	8.55310				
1104CDCAMPS3	10	50.1	39	59	5.64604				
1104CDCAMPS4	10	31.1	1	57	20.6959				
1104CDCAMPS5	10	37.9	12	64	20.3658				
1104CDCAMPS6	10	47.9	27	62	11.5321				

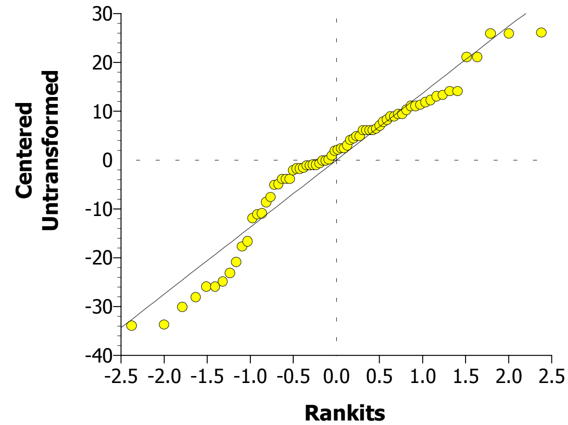
Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
1104CDCAMPSF	56	41	41	55	51	54	42	9	53	25
1104CDCAMPS1	49	46	52	16	49	61	56	56	64	50
1104CDCAMPS2	45	51	56	56	38	30	49	49	53	39
1104CDCAMPS3	59	49	50	52	45	49	48	55	55	39
1104CDCAMPS4	57	8	3	39	43	57	31	40	32	1
1104CDCAMPS5	59	34	33	64	49	12	59	13	44	12
1104CDCAMPS6	36	52	54	44	27	61	62	55	51	37

CETIS Analysis Detail

Graphics





CETIS Data Worksheet

Report Date: 27 Apr-05 9:29 AM
Link: 16-5159-1835/GROVE

Fathead Minnow 7-d Larval Survival and Growth Test | **U.S. EPA Region I Lab**

Start Date: 04 Nov-04 **Species:** Pimephales promelas **Sample Code:** 1104PPCAMLC
Ending Date: 11 Nov-04 **Protocol:** EPA/600/4-91/002 (1994) **Sample Source:** Fort Devens Grove LC SW
Sample Date: 04 Nov-04 **Material:** Potassium chloride **Sample Station:** GLC1

Sample Code	Rep	Pos	# Exposed	1d Surviva	2d Surviva	3d Surviva	4d Surviva	5d Surviva	6d Surviva	7d Surviva	Total Weight-mg	Tare Weight-mg	Pan Count
1104PPCAMLC	1		10	10	10	10	10	9	9	9	1223.24	1218.96	9
1104PPCAMLC	2		10	10	10	9	9	9	9	9	1228.77	1223.3	9
1104PPCAMLC	3		10	10	10	10	10	10	10	10	1241.06	1235.33	10
1104PPCAMLC	4		10	10	10	10	10	10	10	10	1226.99	1222.45	10
1104PPCAMF	1		10	10	10	10	10	9	9	9	1215.98	1211.09	9
1104PPCAMF	2		10	10	10	10	10	10	10	10	1227.64	1221.86	10
1104PPCAMF	3		10	10	10	10	10	10	10	10	1213.78	1207.66	10
1104PPCAMF	4		10	10	10	10	10	10	10	10	1224.59	1218.41	10
1104PPCAMG1	1		10	10	10	10	10	10	10	10	1229.56	1224.05	10
1104PPCAMG1	2		10	10	10	10	10	10	9	9	1228.65	1223.44	9
1104PPCAMG1	3		10	10	10	10	8	8	8	8	1221.5	1217.48	8
1104PPCAMG1	4		10	10	10	10	10	10	10	10	1227.42	1221.64	10
1104PPCAMG2	1		10	10	10	10	10	10	10	10	1216.77	1211.38	10
1104PPCAMG2	2		10	10	10	10	10	10	10	10	1228.05	1222.23	10
1104PPCAMG2	3		10	10	10	10	10	10	10	10	1225.98	1220.26	10
1104PPCAMG2	4		10	10	10	10	10	9	9	9	1235.13	1230	9
1104PPCAMG3	1		10	10	10	10	10	10	10	10	1226.63	1220.93	10
1104PPCAMG3	2		10	10	10	10	10	10	10	10	1230.91	1225.79	10
1104PPCAMG3	3		10	10	10	10	10	10	10	10	1230.92	1224.45	10
1104PPCAMG3	4		10	10	10	10	10	9	9	9	1240.17	1234.96	9
1104PPCAMG4	1		10	10	10	10	10	10	10	10	1224.06	1218.35	10
1104PPCAMG4	2		10	10	10	10	10	10	10	10	1227.23	1222.57	10
1104PPCAMG4	3		10	10	10	10	10	10	10	10	1235.22	1230.86	10
1104PPCAMG4	4		10	10	10	10	10	10	10	10	1222.58	1217.31	10
1104PPCAMG5	1		10	10	10	10	10	10	9	9	1234.44	1230.47	9
1104PPCAMG5	2		10	10	10	10	10	10	10	10	1227.3	1221.59	10
1104PPCAMG5	3		10	10	10	10	10	10	9	9	1229.23	1224.23	9
1104PPCAMG5	4		10	10	10	10	10	10	10	10	1247.97	1242.45	10
1104PPCAMG6	1		10	10	10	10	10	10	10	10	1223.34	1218.69	10
1104PPCAMG6	2		10	10	10	10	10	10	10	10	1232.3	1226.89	10
1104PPCAMG6	3		10	10	10	10	10	10	10	10	1217.96	1212.49	10
1104PPCAMG6	4		10	10	10	10	10	10	10	10	1218.3	1212.65	10

CETIS Test Summary

Report Date: 27 Apr-05 9:35 AM
Link: 16-5159-1835/GROVE

Fathead Minnow 7-d Larval Survival and Growth Test					**U.S. EPA Region I Lab**
Test No:	02-9102-9676	**Test Type:**	Growth-Survival (7d)	**Duration:**	7d 0h
Start Date:	04 Nov-04	**Protocol:**	EPA/600/4-91/002 (1994)	**Species:**	Pimephales promelas
Ending Date:	11 Nov-04	**Dil Water:**	None	**Source:**	In-House Culture
Setup Date:	04 Nov-04 12:00 AM	**Brine:**			
Comments:	ESAT Fort Devens Surface Water PP Chronic Toxicity Test - Grove Pond				

Sample No:	09-7253-2647	**Material:**	Site Surface Water	**Client:**	EPA REGION 1
Sample Date:	04 Nov-04	**Code:**	1104PPCAMF	**Project:**	
Receive Date:		**Source:**	Fort Devens Grove Flannagan SW		
Sample Age:	N/A	**Station:**	GF1		
Comments:	ESAT Fort Devens Surface Water PP Chronic Toxicity Test - Grove Pond				
Sample No:	12-9380-9669	**Material:**	Site Surface Water	**Client:**	EPA REGION 1
Sample Date:	04 Nov-04	**Code:**	1104PPCAMG1	**Project:**	
Receive Date:		**Source:**	Fort Devens Grove SW		
Sample Age:	N/A	**Station:**	G1		
Comments:	ESAT Fort Devens Surface Water PP Chronic Toxicity Test - Grove Pond				
Sample No:	08-5177-0380	**Material:**	Site Surface Water	**Client:**	EPA REGION 1
Sample Date:	04 Nov-04	**Code:**	1104PPCAMG2	**Project:**	
Receive Date:		**Source:**	Fort Devens Grove SW		
Sample Age:	N/A	**Station:**	G2		
Comments:	ESAT Fort Devens Surface Water PP Chronic Toxicity Test - Grove Pond				
Sample No:	11-0340-0881	**Material:**	Site Surface Water	**Client:**	EPA REGION 1
Sample Date:	04 Nov-04	**Code:**	1104PPCAMG3	**Project:**	
Receive Date:		**Source:**	Fort Devens Grove SW		
Sample Age:	N/A	**Station:**	G3		
Comments:	ESAT Fort Devens Surface Water PP Chronic Toxicity Test - Grove Pond				
Sample No:	13-9237-4017	**Material:**	Site Surface Water	**Client:**	EPA REGION 1
Sample Date:	04 Nov-04	**Code:**	1104PPCAMG4	**Project:**	
Receive Date:		**Source:**	Fort Devens Grove SW		
Sample Age:	N/A	**Station:**	G4		
Comments:	ESAT Fort Devens Surface Water PP Chronic Toxicity Test - Grove Pond				
Sample No:	17-9724-4925	**Material:**	Site Surface Water	**Client:**	EPA REGION 1
Sample Date:	04 Nov-04	**Code:**	1104PPCAMG5	**Project:**	
Receive Date:		**Source:**	Fort Devens Grove SW		
Sample Age:	N/A	**Station:**	G5		
Comments:	ESAT Fort Devens Surface Water PP Chronic Toxicity Test - Grove Pond				
Sample No:	18-5928-5190	**Material:**	Site Surface Water	**Client:**	EPA REGION 1
Sample Date:	04 Nov-04	**Code:**	1104PPCAMG6	**Project:**	
Receive Date:		**Source:**	Fort Devens Grove SW		
Sample Age:	N/A	**Station:**	G6		
Comments:	ESAT Fort Devens Surface Water PP Chronic Toxicity Test - Grove Pond				
Sample No:	20-6637-5068	**Material:**	Potassium chloride	**Client:**	EPA REGION 1
Sample Date:	04 Nov-04	**Code:**	1104PPCAMLC	**Project:**	
Receive Date:		**Source:**	Fort Devens Grove LC SW		
Sample Age:	N/A	**Station:**	GLC1		
Comments:	ESAT Fort Devens Surface Water PP Chronic Toxicity Test - Grove Pond				

CETIS Test Summary

Report Date: 27 Apr-05 9:35 AM
Link: 16-5159-1835/GROVE

7d Proportion Survived Summary

Sample Code	Reps	Mean	Minimum	Maximum	SE	SD	CV
1104PPCAMLC	4	0.95000	0.90000	1.00000	0.02887	0.05774	6.08%
1104PPCAMF	4	0.97500	0.90000	1.00000	0.02500	0.05000	5.13%
1104PPCAMG1	4	0.92500	0.80000	1.00000	0.04787	0.09574	10.35%
1104PPCAMG2	4	0.97500	0.90000	1.00000	0.02500	0.05000	5.13%
1104PPCAMG3	4	0.97500	0.90000	1.00000	0.02500	0.05000	5.13%
1104PPCAMG4	4	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
1104PPCAMG5	4	0.95000	0.90000	1.00000	0.02887	0.05774	6.08%
1104PPCAMG6	4	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%

Mean Dry Biomass-mg Summary

Sample Code	Reps	Mean	Minimum	Maximum	SE	SD	CV
1104PPCAMLC	4	0.50050	0.42800	0.57301	0.03516	0.07033	14.05%
1104PPCAMF	4	0.57425	0.48900	0.61799	0.02975	0.05950	10.36%
1104PPCAMG1	4	0.51300	0.40200	0.57800	0.03879	0.07758	15.12%
1104PPCAMG2	4	0.55150	0.51300	0.58201	0.01578	0.03157	5.72%
1104PPCAMG3	4	0.56250	0.51200	0.64701	0.03092	0.06183	10.99%
1104PPCAMG4	4	0.50000	0.43600	0.57101	0.03031	0.06062	12.12%
1104PPCAMG5	4	0.50500	0.39700	0.57101	0.03900	0.07801	15.45%
1104PPCAMG6	4	0.52950	0.46500	0.56500	0.02210	0.04419	8.35%

7d Proportion Survived Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
1104PPCAMLC	0.90000	0.90000	1.00000	1.00000
1104PPCAMF	0.90000	1.00000	1.00000	1.00000
1104PPCAMG1	1.00000	0.90000	0.80000	1.00000
1104PPCAMG2	1.00000	1.00000	1.00000	0.90000
1104PPCAMG3	1.00000	1.00000	1.00000	0.90000
1104PPCAMG4	1.00000	1.00000	1.00000	1.00000
1104PPCAMG5	0.90000	1.00000	0.90000	1.00000
1104PPCAMG6	1.00000	1.00000	1.00000	1.00000

Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
1104PPCAMLC	0.42800	0.54700	0.57301	0.45400
1104PPCAMF	0.48900	0.57800	0.61200	0.61799
1104PPCAMG1	0.55100	0.52101	0.40200	0.57800
1104PPCAMG2	0.53900	0.58201	0.57200	0.51300
1104PPCAMG3	0.57000	0.51200	0.64701	0.52101
1104PPCAMG4	0.57101	0.46600	0.43600	0.52699
1104PPCAMG5	0.39700	0.57101	0.50000	0.55200
1104PPCAMG6	0.46500	0.54100	0.54700	0.56500

CETIS Analysis Detail

Fathead Minnow 7-d Larval Survival and Growth Test — **U.S. EPA Region I Lab**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
7d Proportion Survived	Comparison	16-5159-1835	16-5159-1835	15 Mar-05 10:39 AM	CETISv1.025

Method	Alt H	Data Transform	Z
Dunnett's Multiple Comparison	C > T	Angular (Corrected)	

NOEL	LOEL	Toxic Units	ChV	MSDp
		N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Modified Levene	2.14760	3.49593	0.07701	Equal Variances
Distribution	Shapiro-Wilk W	0.92173	0.90435	0.02984	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0468909	0.0066987	7	0.90	0.51901	Non-Significant Effect
Error	0.1776626	0.0074026	24			
Total	0.22455344	0.0141013	31			

Group Comparisons

Sample vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
1104PPCAMLC	1104PPCAMF	-0.6697	2.48	> 0.0500	0.15088	Non-Significant Effect
1104PPCAMLC	1104PPCAMG1	0.58309	2.48	> 0.0500	0.15088	Non-Significant Effect
1104PPCAMLC	1104PPCAMG2	-0.6697	2.48	> 0.0500	0.15088	Non-Significant Effect
1104PPCAMLC	1104PPCAMG3	-0.6697	2.48	> 0.0500	0.15088	Non-Significant Effect
1104PPCAMLC	1104PPCAMG4	-1.3394	2.48	> 0.0500	0.15088	Non-Significant Effect
1104PPCAMLC	1104PPCAMG5	0	2.48	> 0.0500	0.15088	Non-Significant Effect
1104PPCAMLC	1104PPCAMG6	-1.3394	2.48	> 0.0500	0.15088	Non-Significant Effect

Data Summary

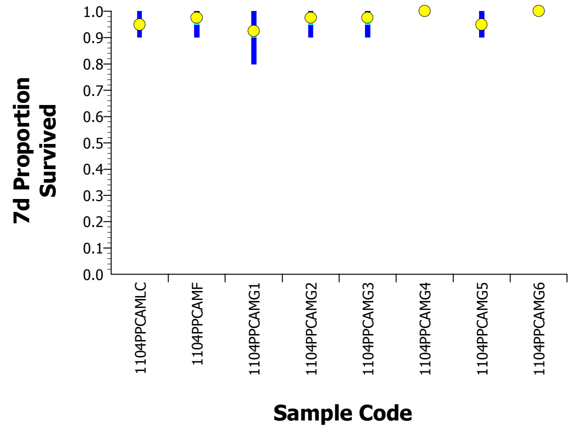
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
1104PPCAMLC	4	0.95000	0.90000	1.00000	0.05773	1.33053	1.24905	1.41202	0.09409
1104PPCAMF	4	0.97500	0.90000	1.00000	0.05000	1.37127	1.24905	1.41202	0.08149
1104PPCAMG1	4	0.92500	0.80000	1.00000	0.09574	1.29506	1.10715	1.41202	0.14695
1104PPCAMG2	4	0.97500	0.90000	1.00000	0.05000	1.37127	1.24905	1.41202	0.08149
1104PPCAMG3	4	0.97500	0.90000	1.00000	0.05000	1.37127	1.24905	1.41202	0.08149
1104PPCAMG4	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027
1104PPCAMG5	4	0.95000	0.90000	1.00000	0.05773	1.33053	1.24905	1.41202	0.09409
1104PPCAMG6	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027

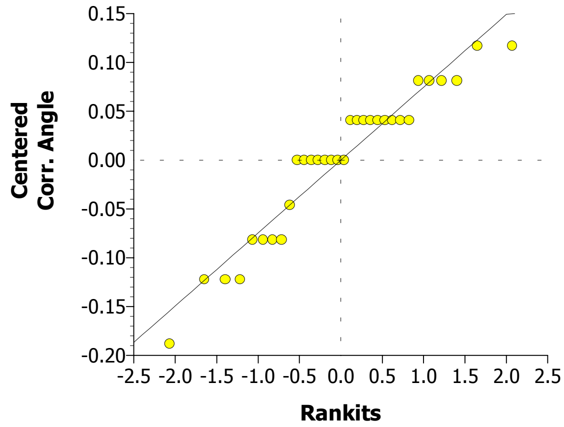
Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
1104PPCAMLC	0.90000	0.90000	1.00000	1.00000						
1104PPCAMF	0.90000	1.00000	1.00000	1.00000						
1104PPCAMG1	1.00000	0.90000	0.80000	1.00000						
1104PPCAMG2	1.00000	1.00000	1.00000	0.90000						
1104PPCAMG3	1.00000	1.00000	1.00000	0.90000						
1104PPCAMG4	1.00000	1.00000	1.00000	1.00000						
1104PPCAMG5	0.90000	1.00000	0.90000	1.00000						
1104PPCAMG6	1.00000	1.00000	1.00000	1.00000						

CETIS Analysis Detail

Graphics





Report Date: 27 Apr-05 9:52 AM
Analysis: 13-9776-0371/GROVE

CETIS Analysis Detail

Fathead Minnow 7-d Larval Survival and Growth Test — **U.S. EPA Region I Lab**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
7d Proportion Survived	Comparison	16-5159-1835	16-5159-1835	23 Mar-05 11:34 AM	CETISv1.025

Method	Alt H	Data Transform	Z
Dunnett's Multiple Comparison	C > T	Angular (Corrected)	

NOEL	LOEL	Toxic Units	ChV	MSDp
		N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Modified Levene	1.98408	3.81173	0.11376	Equal Variances
Distribution	Shapiro-Wilk W	0.90435	0.89591	0.01613	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0424364	0.0070727	6	0.98	0.46135	Non-Significant Effect
Error	0.1511033	0.0071954	21			
Total	0.19353969	0.0142681	27			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
1104PPCAMF		1104PPCAMG1	1.27069	2.45143	> 0.0500	0.14704	Non-Significant Effect
1104PPCAMF		1104PPCAMG2	0	2.45143	> 0.0500	0.14704	Non-Significant Effect
1104PPCAMF		1104PPCAMG3	0	2.45143	> 0.0500	0.14704	Non-Significant Effect
1104PPCAMF		1104PPCAMG4	-0.6793	2.45143	> 0.0500	0.14704	Non-Significant Effect
1104PPCAMF		1104PPCAMG5	0.67926	2.45143	> 0.0500	0.14704	Non-Significant Effect
1104PPCAMF		1104PPCAMG6	-0.6793	2.45143	> 0.0500	0.14704	Non-Significant Effect

Data Summary

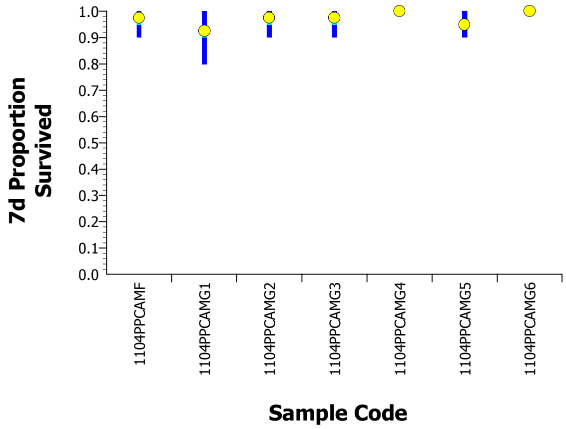
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
1104PPCAMF	4	0.97500	0.90000	1.00000	0.05000	1.37127	1.24905	1.41202	0.08149
1104PPCAMG1	4	0.92500	0.80000	1.00000	0.09574	1.29506	1.10715	1.41202	0.14695
1104PPCAMG2	4	0.97500	0.90000	1.00000	0.05000	1.37127	1.24905	1.41202	0.08149
1104PPCAMG3	4	0.97500	0.90000	1.00000	0.05000	1.37127	1.24905	1.41202	0.08149
1104PPCAMG4	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027
1104PPCAMG5	4	0.95000	0.90000	1.00000	0.05773	1.33053	1.24905	1.41202	0.09409
1104PPCAMG6	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027

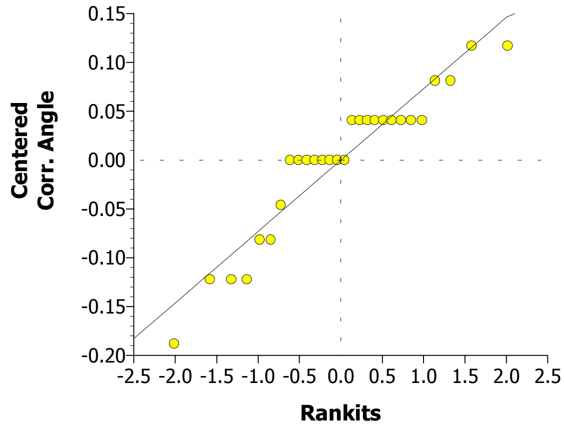
Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
1104PPCAMF	0.90000	1.00000	1.00000	1.00000						
1104PPCAMG1	1.00000	0.90000	0.80000	1.00000						
1104PPCAMG2	1.00000	1.00000	1.00000	0.90000						
1104PPCAMG3	1.00000	1.00000	1.00000	0.90000						
1104PPCAMG4	1.00000	1.00000	1.00000	1.00000						
1104PPCAMG5	0.90000	1.00000	0.90000	1.00000						
1104PPCAMG6	1.00000	1.00000	1.00000	1.00000						

CETIS Analysis Detail

Graphics





Report Date: 27 Apr-05 9:56 AM
Analysis: 01-4001-5173/GROVE

CETIS Analysis Detail

Fathead Minnow 7-d Larval Survival and Growth Test — **U.S. EPA Region I Lab**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Biomass-mg	Comparison	16-5159-1835	16-5159-1835	01 Apr-05 8:55 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Dunnett's Multiple Comparison	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Bartlett	2.86443	18.47531	0.89725	Equal Variances
Distribution	Shapiro-Wilk W	0.94536	0.90435	0.13327	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0246364	0.0035195	7	0.91	0.51741	Non-Significant Effect
Error	0.0931079	0.0038795	24			
Total	0.11774424	0.007399	31			

Group Comparisons

Sample vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
1104PPCAMLC	1104PPCAMF	-1.6744	2.48	> 0.0500	0.10923	Non-Significant Effect
1104PPCAMLC	1104PPCAMG1	-0.2838	2.48	> 0.0500	0.10923	Non-Significant Effect
1104PPCAMLC	1104PPCAMG2	-1.1579	2.48	> 0.0500	0.10923	Non-Significant Effect
1104PPCAMLC	1104PPCAMG3	-1.4077	2.48	> 0.0500	0.10923	Non-Significant Effect
1104PPCAMLC	1104PPCAMG4	0.01143	2.48	> 0.0500	0.10923	Non-Significant Effect
1104PPCAMLC	1104PPCAMG5	-0.1021	2.48	> 0.0500	0.10923	Non-Significant Effect
1104PPCAMLC	1104PPCAMG6	-0.6584	2.48	> 0.0500	0.10923	Non-Significant Effect

Data Summary

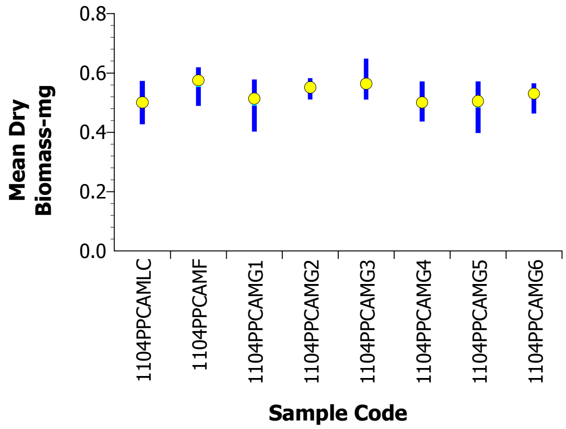
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
1104PPCAMLC	4	0.50050	0.42800	0.57301	0.07033				
1104PPCAMF	4	0.57425	0.48900	0.61799	0.05950				
1104PPCAMG1	4	0.51300	0.40200	0.57800	0.07758				
1104PPCAMG2	4	0.55150	0.51300	0.58201	0.03157				
1104PPCAMG3	4	0.56250	0.51200	0.64701	0.06183				
1104PPCAMG4	4	0.50000	0.43600	0.57101	0.06062				
1104PPCAMG5	4	0.50500	0.39700	0.57101	0.07801				
1104PPCAMG6	4	0.52950	0.46500	0.56500	0.04419				

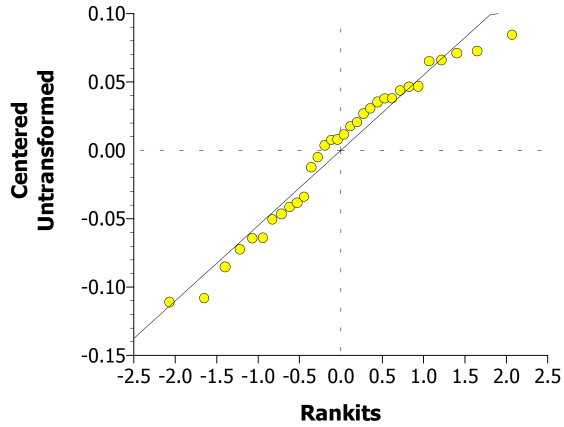
Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
1104PPCAMLC	0.42800	0.54700	0.57301	0.45400						
1104PPCAMF	0.48900	0.57800	0.61200	0.61799						
1104PPCAMG1	0.55100	0.52101	0.40200	0.57800						
1104PPCAMG2	0.53900	0.58201	0.57200	0.51300						
1104PPCAMG3	0.57000	0.51200	0.64701	0.52101						
1104PPCAMG4	0.57101	0.46600	0.43600	0.52699						
1104PPCAMG5	0.39700	0.57101	0.50000	0.55200						
1104PPCAMG6	0.46500	0.54100	0.54700	0.56500						

CETIS Analysis Detail

Graphics





CETIS Analysis Detail

Fathead Minnow 7-d Larval Survival and Growth Test — **U.S. EPA Region I Lab**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Biomass-mg	Comparison	16-5159-1835	16-5159-1835	01 Apr-05 8:56 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Dunnett's Multiple Comparison	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Bartlett	2.75939	16.81190	0.83838	Equal Variances
Distribution	Shapiro-Wilk W	0.94818	0.89591	0.19764	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.020784	0.003464	6	0.93	0.49441	Non-Significant Effect
Error	0.0782705	0.0037272	21			
Total	0.09905442	0.0071912	27			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
1104PPCAMF		1104PPCAMG1	1.41874	2.45143	> 0.0500	0.10583	Non-Significant Effect
1104PPCAMF		1104PPCAMG2	0.52695	2.45143	> 0.0500	0.10583	Non-Significant Effect
1104PPCAMF		1104PPCAMG3	0.2721	2.45143	> 0.0500	0.10583	Non-Significant Effect
1104PPCAMF		1104PPCAMG4	1.71996	2.45143	> 0.0500	0.10583	Non-Significant Effect
1104PPCAMF		1104PPCAMG5	1.60409	2.45143	> 0.0500	0.10583	Non-Significant Effect
1104PPCAMF		1104PPCAMG6	1.03657	2.45143	> 0.0500	0.10583	Non-Significant Effect

Data Summary

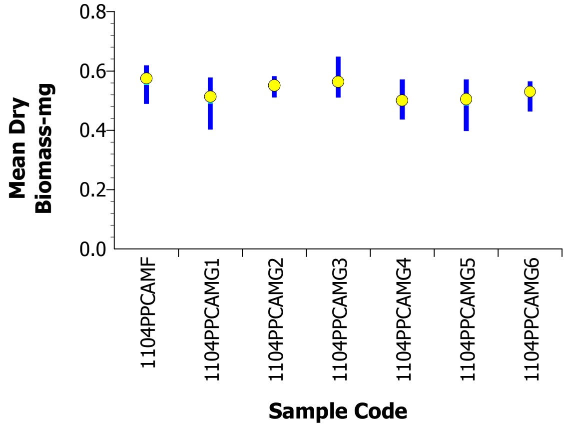
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
1104PPCAMF	4	0.57425	0.48900	0.61799	0.05950				
1104PPCAMG1	4	0.51300	0.40200	0.57800	0.07758				
1104PPCAMG2	4	0.55150	0.51300	0.58201	0.03157				
1104PPCAMG3	4	0.56250	0.51200	0.64701	0.06183				
1104PPCAMG4	4	0.50000	0.43600	0.57101	0.06062				
1104PPCAMG5	4	0.50500	0.39700	0.57101	0.07801				
1104PPCAMG6	4	0.52950	0.46500	0.56500	0.04419				

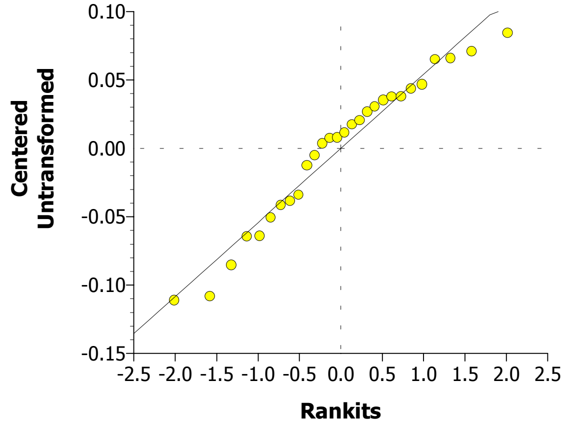
Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
1104PPCAMF	0.48900	0.57800	0.61200	0.61799						
1104PPCAMG1	0.55100	0.52101	0.40200	0.57800						
1104PPCAMG2	0.53900	0.58201	0.57200	0.51300						
1104PPCAMG3	0.57000	0.51200	0.64701	0.52101						
1104PPCAMG4	0.57101	0.46600	0.43600	0.52699						
1104PPCAMG5	0.39700	0.57101	0.50000	0.55200						
1104PPCAMG6	0.46500	0.54100	0.54700	0.56500						

CETIS Analysis Detail

Graphics





CETIS Data Worksheet

Report Date: 27 Apr-05 10:13 AM
Link: 07-8396-9673/PLOW

Fathead Minnow 7-d Larval Survival and Growth Test **U.S. EPA Region I Lab**

Start Date:	04 Nov-04	**Species:**	Pimephales promelas	**Sample Code:**	1104PPCAMPSLC
Ending Date:	11 Nov-04	**Protocol:**	EPA/600/4-91/002 (1994)	**Sample Source:**	Fort Devens Plow Shop LC SW
Sample Date:	04 Nov-04	**Material:**	Potassium chloride	**Sample Station:**	PSLC

Sample Code	Rep	Pos	# Exposed	1d Survival	2d Survival	3d Survival	4d Survival	5d Survival	6d Survival	7d Survival	Total Weight-mg	Tare Weight-mg	Pan Count
1104PPCAMPSLC	1		10	10	10	10	10	9	9	9	1223.24	1218.96	9
1104PPCAMPSLC	2		10	10	10	9	9	9	9	9	1228.77	1223.3	9
1104PPCAMPSLC	3		10	10	10	10	10	10	10	10	1241.06	1235.33	10
1104PPCAMPSLC	4		10	10	10	10	10	10	10	10	1226.99	1222.45	10
1104PPCAMPSF	1		10	10	10	10	10	9	9	9	1215.98	1211.09	9
1104PPCAMPSF	2		10	10	10	10	10	10	10	10	1227.64	1221.86	10
1104PPCAMPSF	3		10	10	10	10	10	10	10	10	1213.78	1207.66	10
1104PPCAMPSF	4		10	10	10	10	10	10	10	10	1224.59	1218.41	10
1104PPCAMPS1	1		10	10	10	10	10	10	10	10	1221.62	1216.26	10
1104PPCAMPS1	2		10	10	10	10	10	10	10	10	1223.71	1218.71	10
1104PPCAMPS1	3		10	10	10	10	10	10	10	10	1233.02	1226.8	10
1104PPCAMPS1	4		10	9	8	8	8	8	8	8	1228.03	1224.91	8
1104PPCAMPS2	1		10	10	10	10	10	10	10	10	1225.88	1219.31	10
1104PPCAMPS2	2		10	10	10	10	10	10	10	10	1228.6	1223.22	10
1104PPCAMPS2	3		10	10	10	10	10	10	10	10	1232.97	1227.57	10
1104PPCAMPS2	4		10	10	10	10	10	10	10	10	1220.43	1214.46	10
1104PPCAMPS3	1		10	10	10	10	10	10	10	10	1222.8	1217.29	10
1104PPCAMPS3	2		10	10	10	10	10	10	9	9	1222.36	1217.65	9
1104PPCAMPS3	3		10	10	10	10	10	10	10	10	1235.13	1229.28	10
1104PPCAMPS3	4		10	10	10	10	10	10	10	10	1235.28	1229.47	10
1104PPCAMPS4	1		10	10	10	10	9	9	9	9	1219.11	1214.61	9
1104PPCAMPS4	2		10	10	10	10	10	10	10	10	1237.33	1232.2	10
1104PPCAMPS4	3		10	10	10	10	10	10	10	10	1222.15	1215.75	10
1104PPCAMPS4	4		10	10	10	10	10	10	10	9	1229.05	1223.78	9
1104PPCAMPS5	1		10	10	10	10	10	10	10	10	1241.72	1236.3	10
1104PPCAMPS5	2		10	10	10	10	10	10	10	10	1224.55	1219.4	10
1104PPCAMPS5	3		10	10	10	10	10	10	10	10	1224	1218.68	10
1104PPCAMPS5	4		10	10	10	10	10	10	10	10	1224.47	1218.25	10
1104PPCAMPS6	1		10	10	10	10	10	10	10	10	1219.48	1213.93	10
1104PPCAMPS6	2		10	10	10	10	10	10	10	10	1222.28	1216.02	10
1104PPCAMPS6	3		10	10	10	10	10	10	9	9	1215.82	1210.71	9
1104PPCAMPS6	4		10	10	10	10	9	9	9	9	1220.71	1215.16	9

CETIS Test Summary

Report Date: 27 Apr-05 10:16 AM
Link: 07-8396-9673/PLOW

Fathead Minnow 7-d Larval Survival and Growth Test					U.S. EPA Region I Lab
Test No:	19-1344-9777	**Test Type:**	Growth-Survival (7d)	**Duration:**	7d 0h
Start Date:	04 Nov-04	**Protocol:**	EPA/600/4-91/002 (1994)	**Species:**	Pimephales promelas
Ending Date:	11 Nov-04	**Dil Water:**	None	**Source:**	In-House Culture
Setup Date:	04 Nov-04 12:00 AM	**Brine:**			
Comments:	ESAT Fort Devens Surface Water PP Chronic Toxicity Test - Plow Shop Pond				

Sample No:	01-5788-2961	**Material:**	Site Surface Water	**Client:**	EPA REGION 1
Sample Date:	04 Nov-04	**Code:**	1104PPCAMPS1	**Project:**	
Receive Date:		**Source:**	Fort Devens Plow Shop SW		
Sample Age:	N/A	**Station:**	PS1		
Comments:	ESAT Fort Devens Surface Water PP Chronic Toxicity Test - Plow Shop Pond				
Sample No:	16-7597-2676	**Material:**	Site Surface Water	**Client:**	EPA REGION 1
Sample Date:	04 Nov-04	**Code:**	1104PPCAMPS2	**Project:**	
Receive Date:		**Source:**	Fort Devens Plow Shop SW		
Sample Age:	N/A	**Station:**	PS2		
Comments:	ESAT Fort Devens Surface Water PP Chronic Toxicity Test - Plow Shop Pond				
Sample No:	07-1409-5254	**Material:**	Site Surface Water	**Client:**	EPA REGION 1
Sample Date:	04 Nov-04	**Code:**	1104PPCAMPS3	**Project:**	
Receive Date:		**Source:**	Fort Devens Plow Shop SW		
Sample Age:	N/A	**Station:**	PS3		
Comments:	ESAT Fort Devens Surface Water PP Chronic Toxicity Test - Plow Shop Pond				
Sample No:	01-1960-0668	**Material:**	Site Surface Water	**Client:**	EPA REGION 1
Sample Date:	04 Nov-04	**Code:**	1104PPCAMPS4	**Project:**	
Receive Date:		**Source:**	Fort Devens Plow Shop SW		
Sample Age:	N/A	**Station:**	PS4		
Comments:	ESAT Fort Devens Surface Water PP Chronic Toxicity Test - Plow Shop Pond				
Sample No:	07-2003-4760	**Material:**	Site Surface Water	**Client:**	EPA REGION 1
Sample Date:	04 Nov-04	**Code:**	1104PPCAMPS5	**Project:**	
Receive Date:		**Source:**	Fort Devens Plow Shop SW		
Sample Age:	N/A	**Station:**	PS5		
Comments:	ESAT Fort Devens Surface Water PP Chronic Toxicity Test - Plow Shop Pond				
Sample No:	09-8530-1670	**Material:**	Site Surface Water	**Client:**	EPA REGION 1
Sample Date:	04 Nov-04	**Code:**	1104PPCAMPS6	**Project:**	
Receive Date:		**Source:**	Fort Devens Plow Shop SW		
Sample Age:	N/A	**Station:**	PS6		
Comments:	ESAT Fort Devens Surface Water PP Chronic Toxicity Test - Plow Shop Pond				
Sample No:	17-3082-4894	**Material:**	Site Surface Water	**Client:**	EPA REGION 1
Sample Date:	04 Nov-04	**Code:**	1104PPCAMPSF	**Project:**	
Receive Date:		**Source:**	Fort Devens Plow Shop Flannagan S		
Sample Age:	N/A	**Station:**	PSF		
Comments:	ESAT Fort Devens Surface Water PP Chronic Toxicity Test - Plow Shop Pond				
Sample No:	05-9088-9090	**Material:**	Potassium chloride	**Client:**	EPA REGION 1
Sample Date:	04 Nov-04	**Code:**	1104PPCAMPSLC	**Project:**	
Receive Date:		**Source:**	Fort Devens Plow Shop LC SW		
Sample Age:	N/A	**Station:**	PSLC		
Comments:	ESAT Fort Devens Surface Water PP Chronic Toxicity Test - Plow Shop Pond				

CETIS Test Summary

Report Date: 27 Apr-05 10:16 AM
Link: 07-8396-9673/PLOW

7d Proportion Survived Summary

Sample Code	Reps	Mean	Minimum	Maximum	SE	SD	CV
1104PPCAMPSLC	4	0.95000	0.90000	1.00000	0.02887	0.05774	6.08%
1104PPCAMPSF	4	0.97500	0.90000	1.00000	0.02500	0.05000	5.13%
1104PPCAMPS1	4	0.95000	0.80000	1.00000	0.05000	0.10000	10.53%
1104PPCAMPS2	4	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
1104PPCAMPS3	4	0.97500	0.90000	1.00000	0.02500	0.05000	5.13%
1104PPCAMPS4	4	0.95000	0.90000	1.00000	0.02887	0.05774	6.08%
1104PPCAMPS5	4	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
1104PPCAMPS6	4	0.95000	0.90000	1.00000	0.02887	0.05774	6.08%

Mean Dry Biomass-mg Summary

Sample Code	Reps	Mean	Minimum	Maximum	SE	SD	CV
1104PPCAMPSLC	4	0.50050	0.42800	0.57301	0.03516	0.07033	14.05%
1104PPCAMPSF	4	0.57425	0.48900	0.61799	0.02975	0.05950	10.36%
1104PPCAMPS1	4	0.49250	0.31200	0.62200	0.06538	0.13076	26.55%
1104PPCAMPS2	4	0.58300	0.53800	0.65699	0.02820	0.05641	9.68%
1104PPCAMPS3	4	0.54700	0.47100	0.58500	0.02645	0.05289	9.67%
1104PPCAMPS4	4	0.53250	0.45000	0.64000	0.03955	0.07911	14.86%
1104PPCAMPS5	4	0.55275	0.51500	0.62200	0.02375	0.04749	8.59%
1104PPCAMPS6	4	0.56175	0.51100	0.62600	0.02380	0.04759	8.47%

7d Proportion Survived Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
1104PPCAMPSLC	0.90000	0.90000	1.00000	1.00000
1104PPCAMPSF	0.90000	1.00000	1.00000	1.00000
1104PPCAMPS1	1.00000	1.00000	1.00000	0.80000
1104PPCAMPS2	1.00000	1.00000	1.00000	1.00000
1104PPCAMPS3	1.00000	0.90000	1.00000	1.00000
1104PPCAMPS4	0.90000	1.00000	1.00000	0.90000
1104PPCAMPS5	1.00000	1.00000	1.00000	1.00000
1104PPCAMPS6	1.00000	1.00000	0.90000	0.90000

Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
1104PPCAMPSLC	0.42800	0.54700	0.57301	0.45400
1104PPCAMPSF	0.48900	0.57800	0.61200	0.61799
1104PPCAMPS1	0.53600	0.50000	0.62200	0.31200
1104PPCAMPS2	0.65699	0.53800	0.54000	0.59701
1104PPCAMPS3	0.55100	0.47100	0.58500	0.58101
1104PPCAMPS4	0.45000	0.51300	0.64000	0.52700
1104PPCAMPS5	0.54199	0.51500	0.53199	0.62200
1104PPCAMPS6	0.55499	0.62600	0.51100	0.55499

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	Test ID: Plow P.p.	Sample ID:	Plow FHM
End Date:	Lab ID:	Sample Type:	AMB1-Ambient water
Sample Date:	Protocol: EPAF 91-EPA Freshwater	Test Species:	PP-Pimephales promelas
Comments:			

Conc-	1	2	3	4
L-Lab Control	0.9000	0.9000	1.0000	1.0000
R-Reference	0.9000	1.0000	1.0000	1.0000
Plow 1	1.0000	1.0000	1.0000	0.8000
Plow 2	1.0000	1.0000	1.0000	1.0000
Plow 3	1.0000	0.9000	1.0000	1.0000
Plow 4	0.9000	1.0000	1.0000	0.9000
Plow 5	1.0000	1.0000	1.0000	1.0000
Plow 6	1.0000	1.0000	0.9000	0.9000

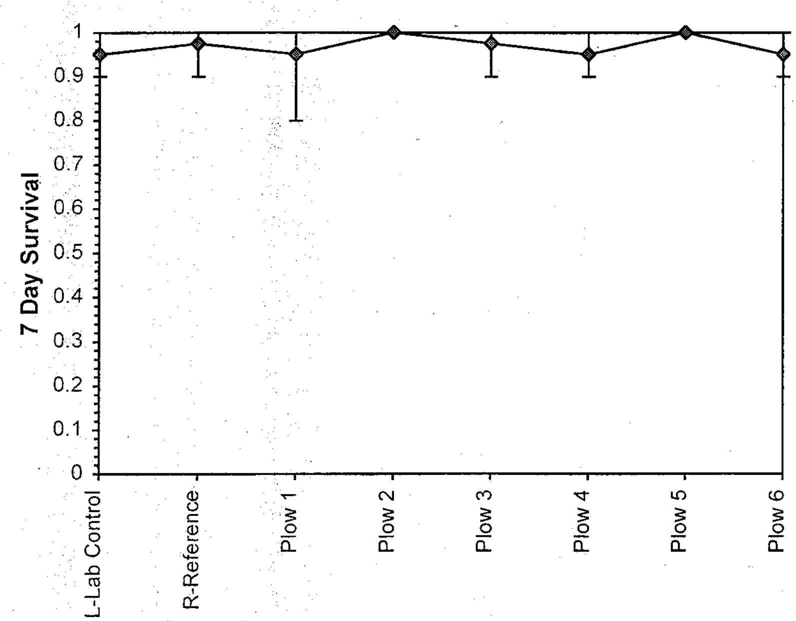
			Transform: Arcsin Square Root					Rank	1-Tailed
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical
L-Lab Control	0.9500	0.9744	1.3305	1.2490	1.4120	7.072	4		
R-Reference	0.9750	1.0000	1.3713	1.2490	1.4120	5.942	4		
Plow 1	0.9500	0.9744	1.3358	1.1071	1.4120	11.411	4	19.00	10.00
Plow 2	1.0000	1.0256	1.4120	1.4120	1.4120	0.000	4	22.00	10.00
Plow 3	0.9750	1.0000	1.3713	1.2490	1.4120	5.942	4	20.00	10.00
Plow 4	0.9500	0.9744	1.3305	1.2490	1.4120	7.072	4	18.00	10.00
Plow 5	1.0000	1.0256	1.4120	1.4120	1.4120	0.000	4	22.00	10.00
Plow 6	0.9500	0.9744	1.3305	1.2490	1.4120	7.072	4	18.00	10.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.86255	0.896	-0.9839	0.86566
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 0.54)	0.65465	2.44691		

Hypothesis Test (1-tail, 0.05)

Steel's Many-One Rank Test indicates no significant differences

Dose-Response Plot



Comparison to Ref.

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	Test ID: Plow P.p.	Sample ID:	Plow FHM
End Date:	Lab ID:	Sample Type:	AMB1-Ambient water
Sample Date:	Protocol: EPAF 91-EPA Freshwater	Test Species:	PP-Pimephales promelas
Comments:			

Conc-	1	2	3	4
L-Lab Control	0.9000	0.9000	1.0000	1.0000
R-Reference	0.9000	1.0000	1.0000	1.0000
Plow 1	1.0000	1.0000	1.0000	0.8000
Plow 2	1.0000	1.0000	1.0000	1.0000
Plow 3	1.0000	0.9000	1.0000	1.0000
Plow 4	0.9000	1.0000	1.0000	0.9000
Plow 5	1.0000	1.0000	1.0000	1.0000
Plow 6	1.0000	1.0000	0.9000	0.9000

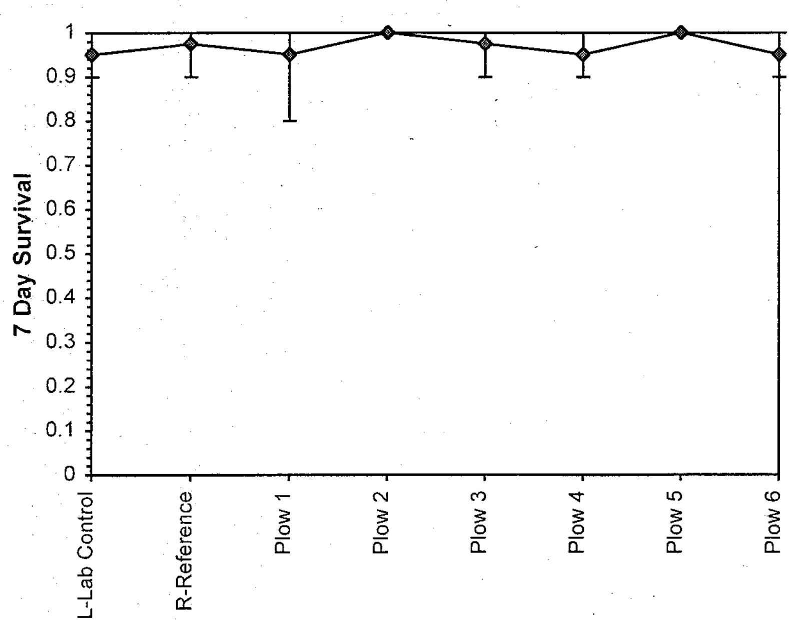
			Transform: Arcsin Square Root					Rank	1-Tailed
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical
L-Lab Control	0.9500	0.9744	1.3305	1.2490	1.4120	7.072	4		
R-Reference	0.9750	1.0000	1.3713	1.2490	1.4120	5.942	4		
Plow 1	0.9500	0.9744	1.3358	1.1071	1.4120	11.411	4	17.50	10.00
Plow 2	1.0000	1.0256	1.4120	1.4120	1.4120	0.000	4	20.00	10.00
Plow 3	0.9750	1.0000	1.3713	1.2490	1.4120	5.942	4	18.00	10.00
Plow 4	0.9500	0.9744	1.3305	1.2490	1.4120	7.072	4	16.00	10.00
Plow 5	1.0000	1.0256	1.4120	1.4120	1.4120	0.000	4	20.00	10.00
Plow 6	0.9500	0.9744	1.3305	1.2490	1.4120	7.072	4	16.00	10.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.8625	0.896	-1.1832	1.28831
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 0.54)	0.65465	2.44691		

Hypothesis Test (1-tail, 0.05)

Steel's Many-One Rank Test indicates no significant differences

Dose-Response Plot



 ToxCalc v5.0.23 Reviewed by:_____

CETIS Analysis Detail

Fathead Minnow 7-d Larval Survival and Growth Test	U.S. EPA Region I Lab

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Biomass-mg	Comparison	07-8396-9673	07-8396-9673	01 Apr-05 8:56 AM	CETISv1.025

Method	Alt H	Data Transform	Z
Dunnett's Multiple Comparison	C > T	Untransformed	

NOEL	LOEL	Toxic Units	ChV	MSDp
		N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Bartlett	5.27513	18.47531	0.62643	Equal Variances
Distribution	Shapiro-Wilk W	0.97935	0.90435	0.81536	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0300225	0.0042889	7	0.81	0.58742	Non-Significant Effect
Error	0.1270289	0.0052929	24			
Total	0.15705135	0.0095818	31			

Group Comparisons

Sample vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
1104PPCAMPS	1104PPCAMPS	-1.4335	2.48	> 0.0500	0.12758	Non-Significant Effect
1104PPCAMPS	1104PPCAMPS	0.15560	2.48	> 0.0500	0.12758	Non-Significant Effect
1104PPCAMPS	1104PPCAMPS	-1.6037	2.48	> 0.0500	0.12758	Non-Significant Effect
1104PPCAMPS	1104PPCAMPS	-0.9038	2.48	> 0.0500	0.12758	Non-Significant Effect
1104PPCAMPS	1104PPCAMPS	-0.622	2.48	> 0.0500	0.12758	Non-Significant Effect
1104PPCAMPS	1104PPCAMPS	-1.0155	2.48	> 0.0500	0.12758	Non-Significant Effect
1104PPCAMPS	1104PPCAMPS	-1.1905	2.48	> 0.0500	0.12758	Non-Significant Effect

Data Summary

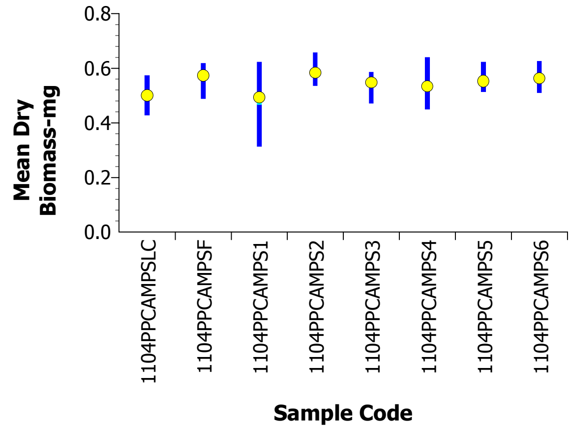
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
1104PPCAMPSLC	4	0.50050	0.42800	0.57301	0.07033				
1104PPCAMPSF	4	0.57425	0.48900	0.61799	0.05950				
1104PPCAMPS1	4	0.49250	0.31200	0.62200	0.13076				
1104PPCAMPS2	4	0.58300	0.53800	0.65699	0.05641				
1104PPCAMPS3	4	0.54700	0.47100	0.58500	0.05289				
1104PPCAMPS4	4	0.53250	0.45000	0.64000	0.07911				
1104PPCAMPS5	4	0.55275	0.51500	0.62200	0.04749				
1104PPCAMPS6	4	0.56175	0.51100	0.62600	0.04759				

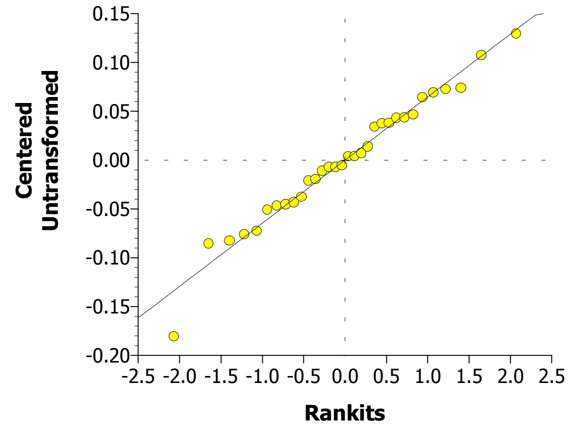
Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
1104PPCAMPSLC	0.42800	0.54700	0.57301	0.45400						
1104PPCAMPSF	0.48900	0.57800	0.61200	0.61799						
1104PPCAMPS1	0.53600	0.50000	0.62200	0.31200						
1104PPCAMPS2	0.65699	0.53800	0.54000	0.59701						
1104PPCAMPS3	0.55100	0.47100	0.58500	0.58101						
1104PPCAMPS4	0.45000	0.51300	0.64000	0.52700						
1104PPCAMPS5	0.54199	0.51500	0.53199	0.62200						
1104PPCAMPS6	0.55499	0.62600	0.51100	0.55499						

CETIS Analysis Detail

Graphics





Report Date: 27 Apr-05 10:24 AM
Analysis: 05-0205-9702/PLOW

CETIS Analysis Detail

Fathead Minnow 7-d Larval Survival and Growth Test	U.S. EPA Region I Lab

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Biomass-mg	Comparison	07-8396-9673	07-8396-9673	01 Apr-05 8:56 AM	CETISv1.025

Method	Alt H	Data Transform	Z
Dunnett's Multiple Comparison	C > T	Untransformed	

NOEL	LOEL	Toxic Units	ChV	MSDp
		N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Bartlett	5.25904	16.81190	0.51104	Equal Variances
Distribution	Shapiro-Wilk W	0.97560	0.89591	0.74658	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0217547	0.0036258	6	0.68	0.66845	Non-Significant Effect
Error	0.1121915	0.0053425	21			
Total	0.13394613	0.0089682	27			

Group Comparisons

Sample vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
1104PPCAMPS	1104PPCAMPS	1.58174	2.45143	> 0.0500	0.1267	Non-Significant Effect
1104PPCAMPS	1104PPCAMPS	-0.1693	2.45143	> 0.0500	0.1267	Non-Significant Effect
1104PPCAMPS	1104PPCAMPS	0.52723	2.45143	> 0.0500	0.1267	Non-Significant Effect
1104PPCAMPS	1104PPCAMPS	0.80776	2.45143	> 0.0500	0.1267	Non-Significant Effect
1104PPCAMPS	1104PPCAMPS	0.41604	2.45143	> 0.0500	0.1267	Non-Significant Effect
1104PPCAMPS	1104PPCAMPS	0.24191	2.45143	> 0.0500	0.1267	Non-Significant Effect

Data Summary

		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
1104PPCAMPSF	4	0.57425	0.48900	0.61799	0.05950				
1104PPCAMPS1	4	0.49250	0.31200	0.62200	0.13076				
1104PPCAMPS2	4	0.58300	0.53800	0.65699	0.05641				
1104PPCAMPS3	4	0.54700	0.47100	0.58500	0.05289				
1104PPCAMPS4	4	0.53250	0.45000	0.64000	0.07911				
1104PPCAMPS5	4	0.55275	0.51500	0.62200	0.04749				
1104PPCAMPS6	4	0.56175	0.51100	0.62600	0.04759				

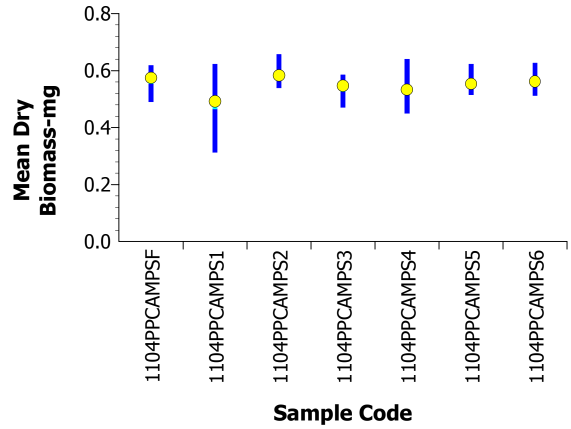
Data Detail

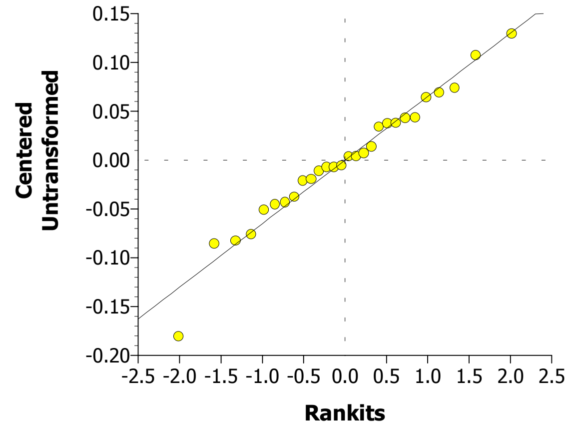
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
1104PPCAMPSF	0.48900	0.57800	0.61200	0.61799						
1104PPCAMPS1	0.53600	0.50000	0.62200	0.31200						
1104PPCAMPS2	0.65699	0.53800	0.54000	0.59701						
1104PPCAMPS3	0.55100	0.47100	0.58500	0.58101						
1104PPCAMPS4	0.45000	0.51300	0.64000	0.52700						
1104PPCAMPS5	0.54199	0.51500	0.53199	0.62200						
1104PPCAMPS6	0.55499	0.62600	0.51100	0.55499						

Analyst:________ Approval:________

CETIS Analysis Detail

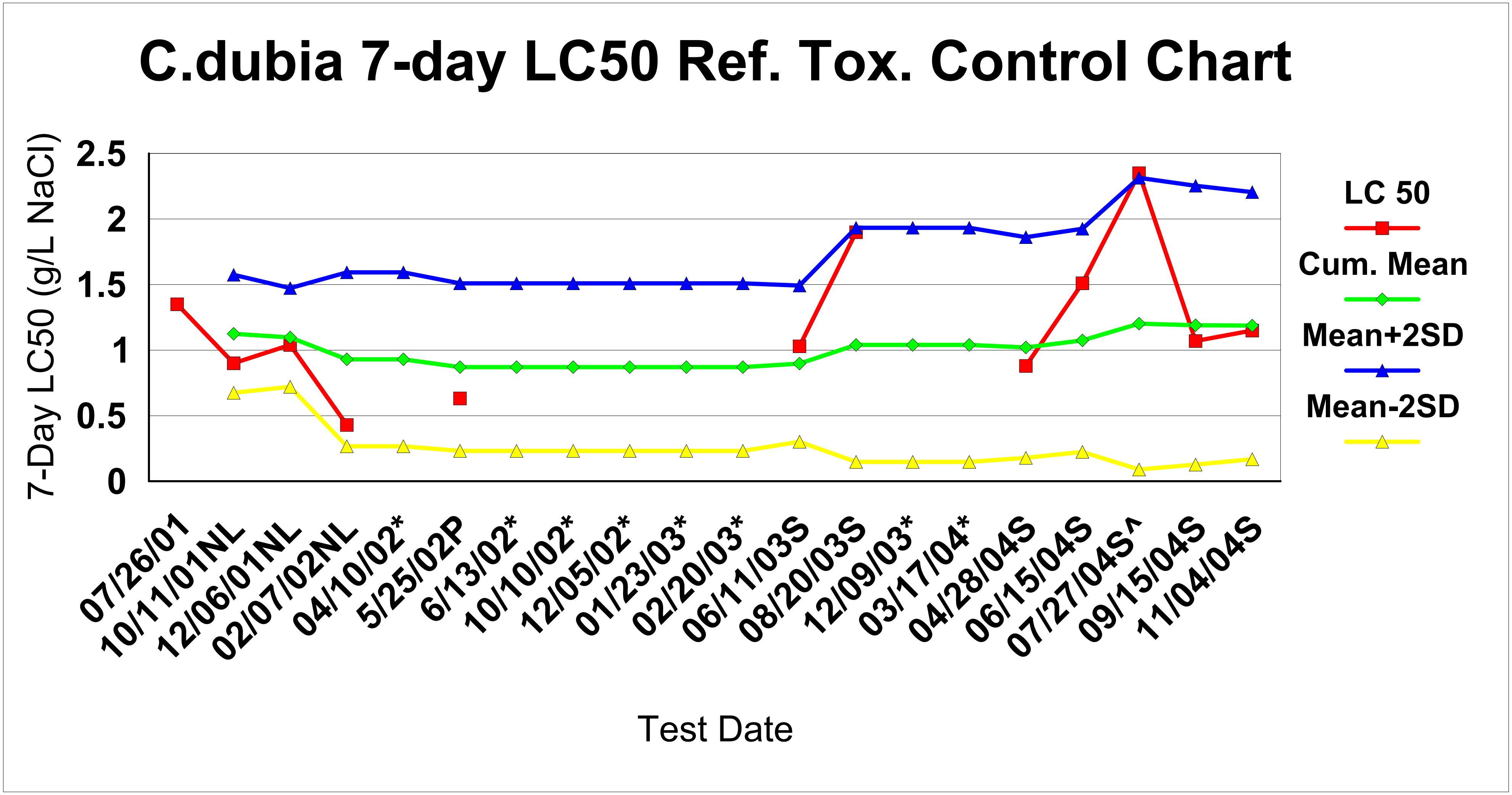
Graphics

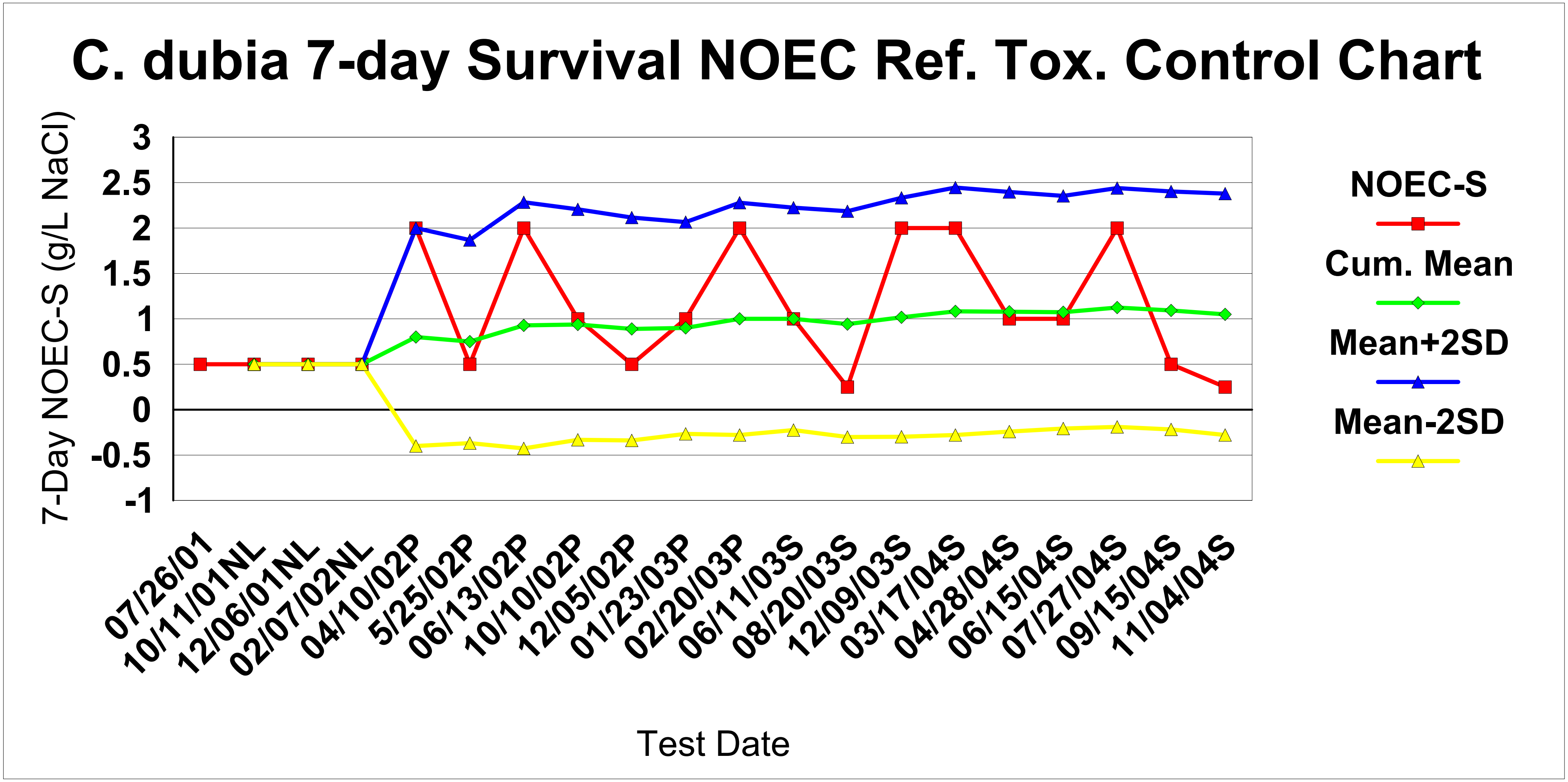




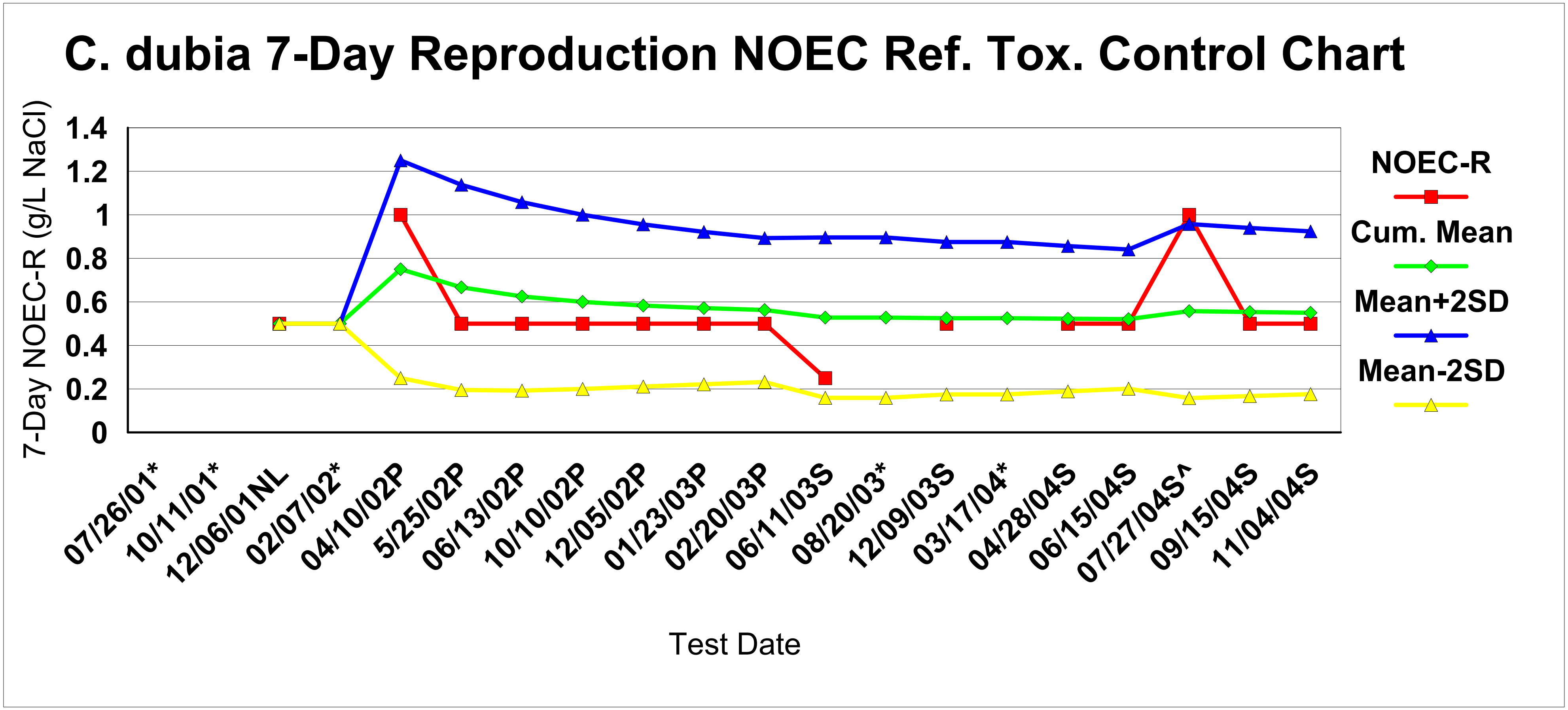
Appendix E

Control Charts for *C. dubia* and *P. promelas*

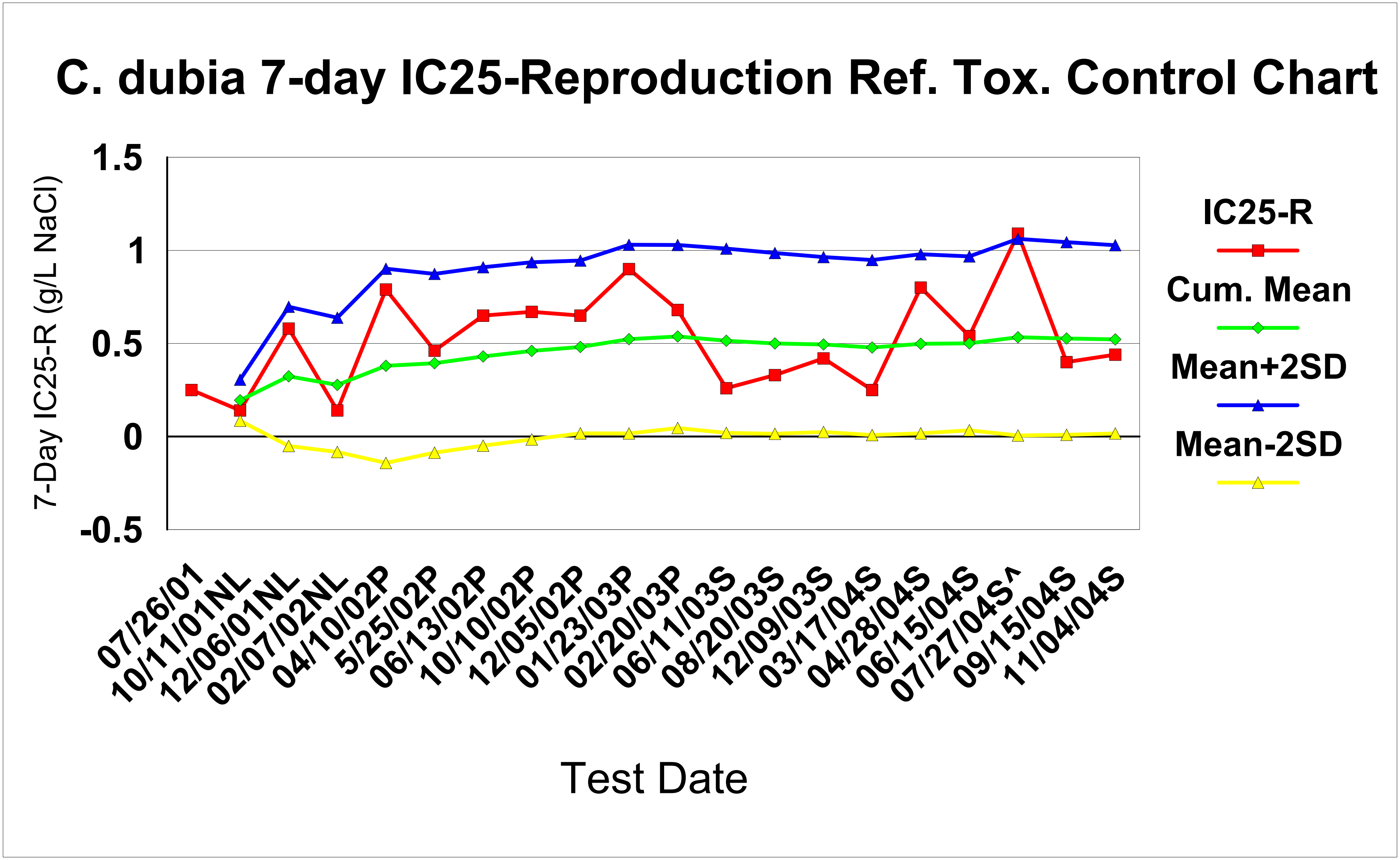

C.dubia 7-day LC50 Ref. Tox. Control Chart
7-Day LC50 (g/L NaCl)
2.5
2
1.5
1
0.5
0
07/26/01
10/11/01NL
12/06/01NL
02/07/02NL
04/10/02*
5/25/02P
6/13/02*
10/10/02*
12/05/02*
01/23/03*
02/20/03*
06/11/03S
08/20/03S
12/09/03*
03/17/04*
04/28/04S
06/15/04S
07/27/04S^
09/15/04S
11/04/04S
Test Date
LC 50
Cum. Mean
Mean+2SD
Mean-2SD

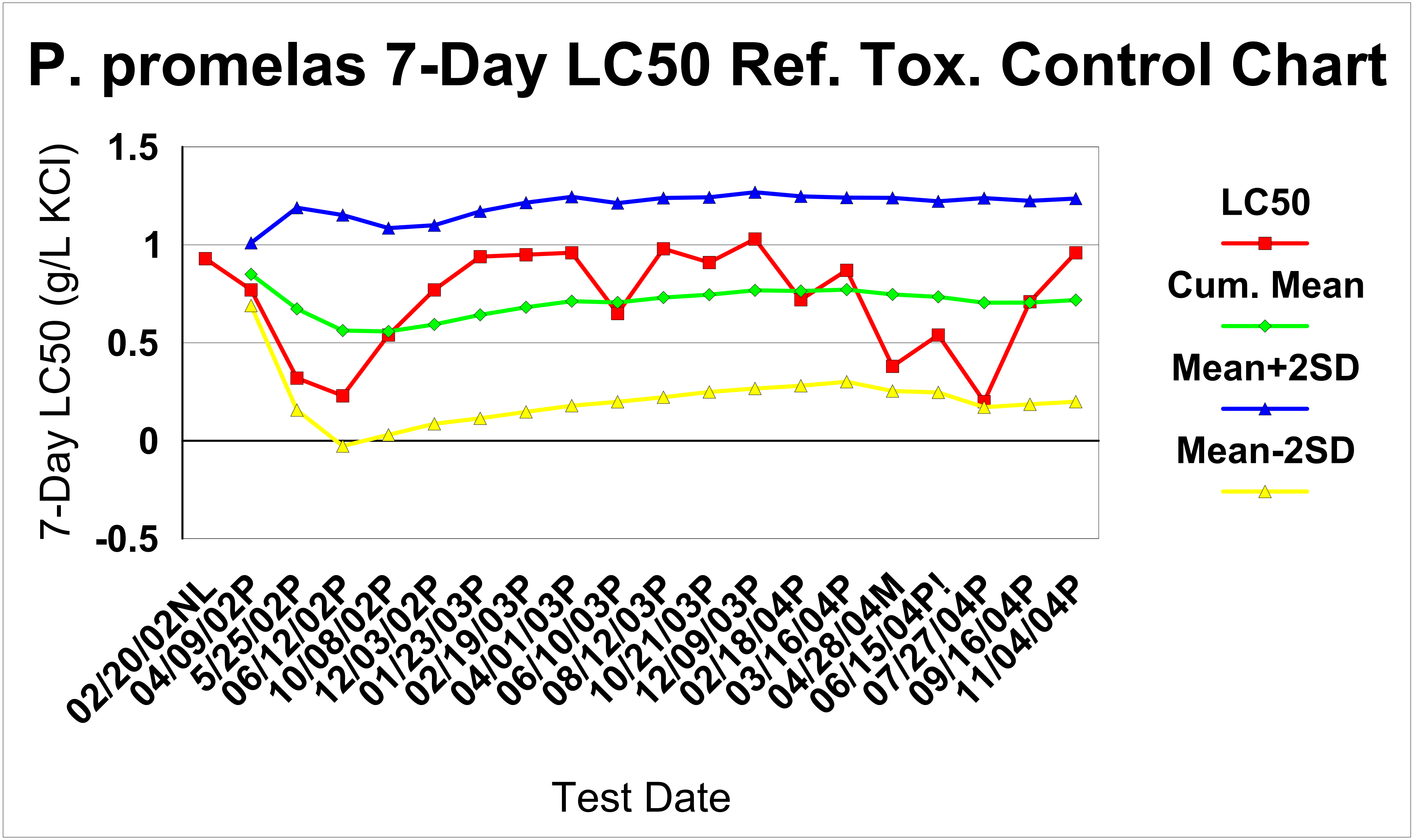


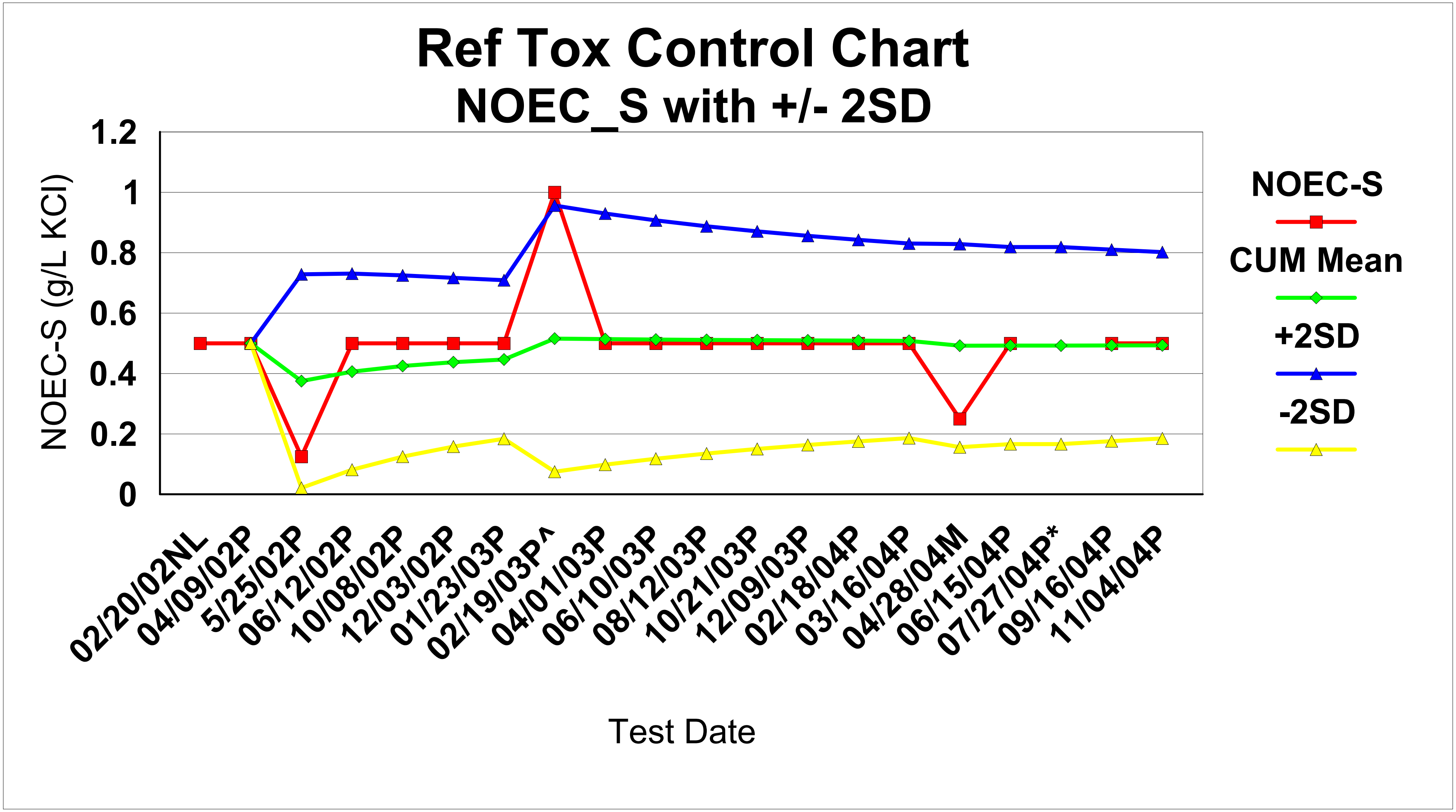
C. dubia 7-day Survival NOEC Ref. Tox. Control Chart
7-Day NOEC-S (g/L NaCl)
3
2.5
2
1.5
1
0.5
0
-0.5
-1
07/26/01
10/11/01NL
12/06/01NL
02/07/02NL
04/10/02P
5/25/02P
06/13/02P
10/10/02P
12/05/02P
01/23/03P
02/20/03P
06/11/03S
08/20/03S
12/09/03S
03/17/04S
04/28/04S
06/15/04S
07/27/04S
09/15/04S
11/04/04S
Test Date
NOEC-S
Cum. Mean
Mean+2SD
Mean-2SD



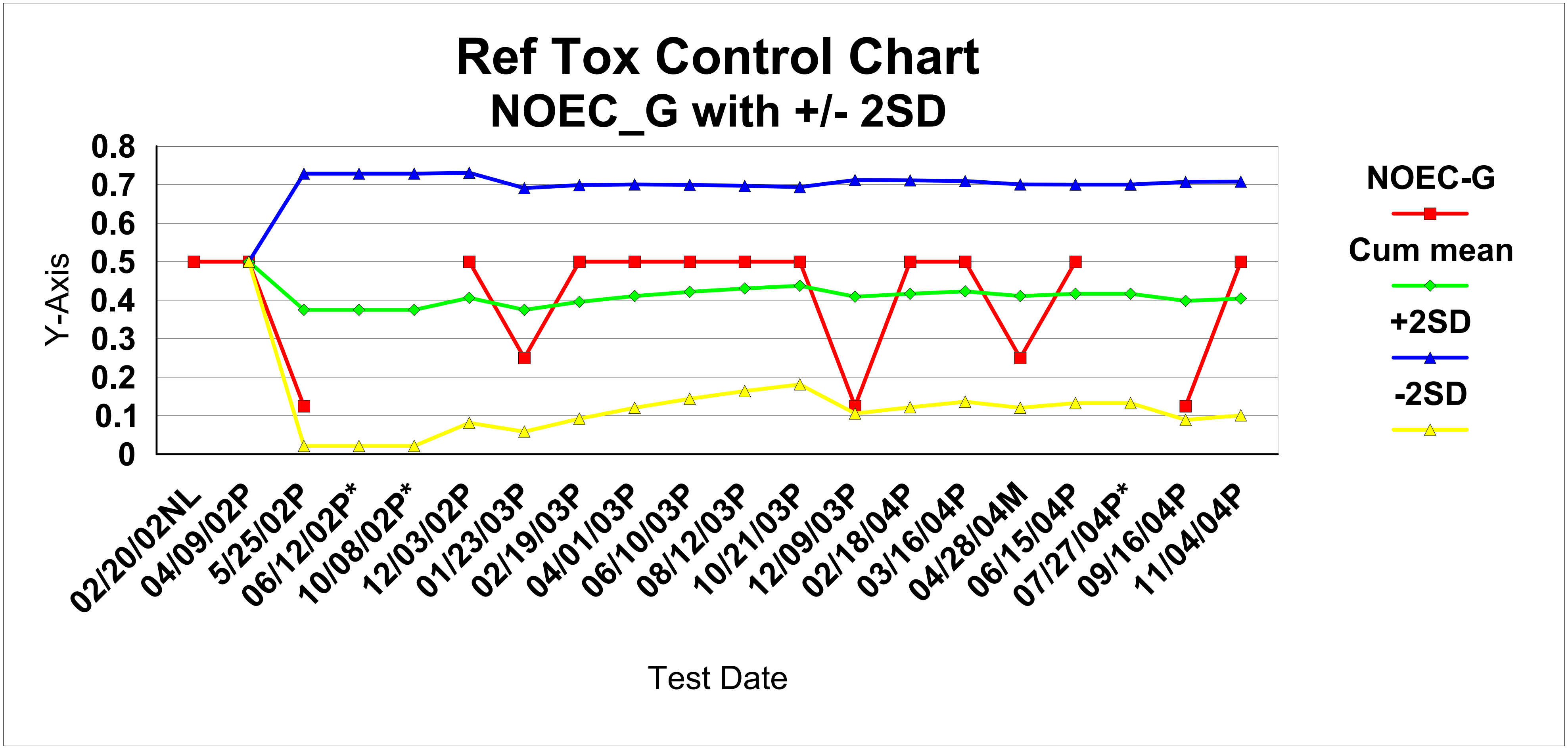
C. dubia 7-Day Reproduction NOEC Ref. Tox. Control Chart
7-Day NOEC-R (g/L NaCl)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
07/26/01*
10/11/01*
12/06/01NL
02/07/02*
04/10/02P
5/25/02P
06/13/02P
10/10/02P
12/05/02P
01/23/03P
02/20/03P
06/11/03S
08/20/03*
12/09/03S
03/17/04*
04/28/04S
06/15/04S
07/27/04S^
09/15/04S
11/04/04S
Test Date
NOEC-R
Cum. Mean
Mean+2SD
Mean-2SD


C. dubia 7-day IC25-Reproduction Ref. Tox. Control Chart
7-Day IC25-R (g/L NaCl)
1.5
1
0.5
0
-0.5
IC25-R
Cum. Mean
Mean+2SD
Mean-2SD
07/26/01
10/11/01NL
12/06/01NL
02/07/02NL
04/10/02P
5/25/02P
06/13/02P
10/10/02P
12/05/02P
01/23/03P
02/20/03P
06/11/03S
08/20/03S
12/09/03S
03/17/04S
04/28/04S
06/15/04S
07/27/04S^
09/15/04S
11/04/04S
Test Date

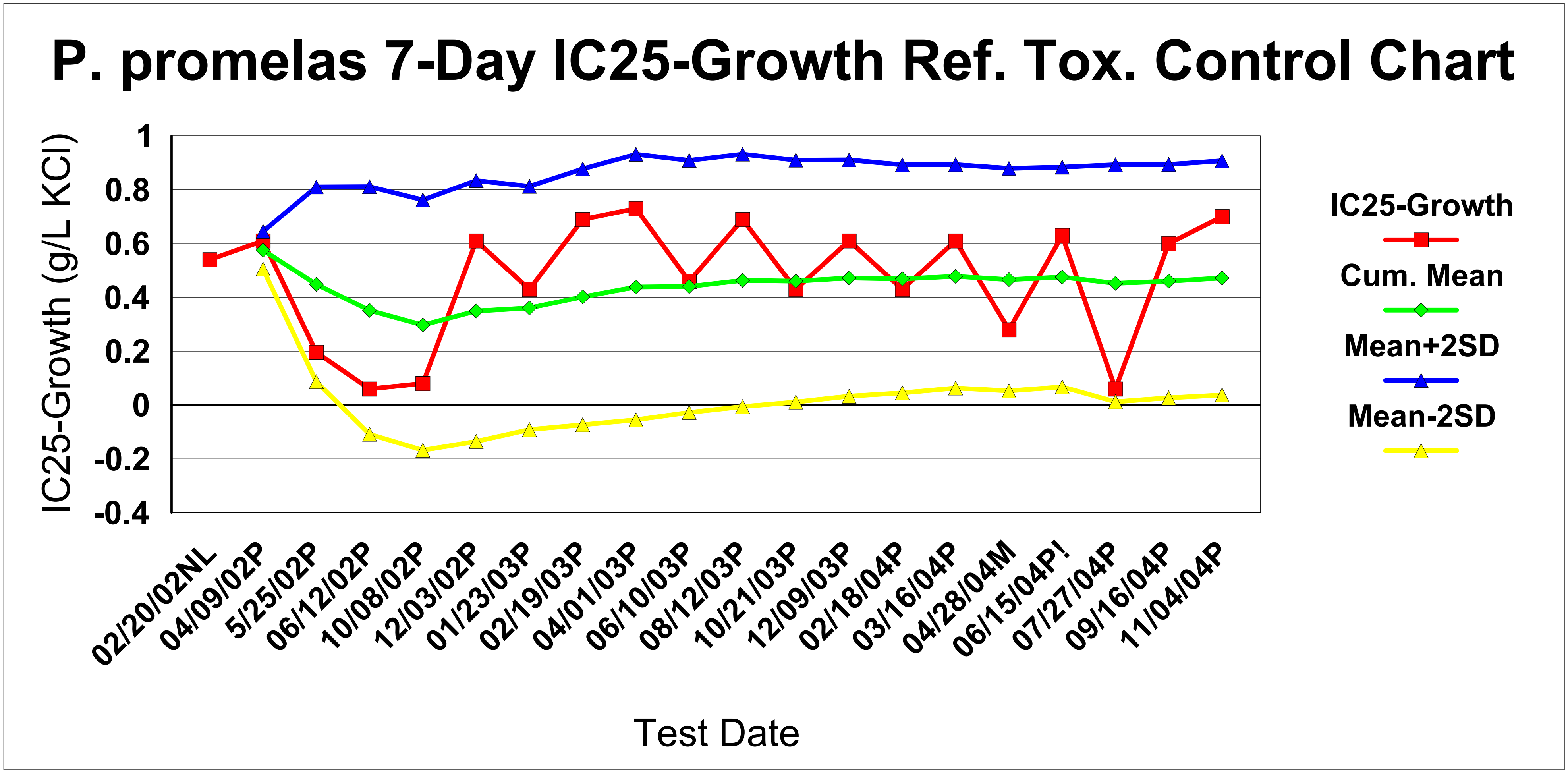

P. promelas 7-Day LC50 Ref. Tox. Control Chart
7-Day LC50 (g/L KCl)
1.5
1
0.5
0
-0.5
02/20/02NL
04/09/02P
5/25/02P
06/12/02P
10/08/02P
12/03/02P
01/23/03P
02/19/03P
04/01/03P
06/10/03P
08/12/03P
10/21/03P
12/09/03P
02/18/04P
03/16/04P
04/28/04M
06/15/04P!
07/27/04P
09/16/04P
11/04/04P
Test Date
LC50
Cum. Mean
Mean+2SD
Mean-2SD



Ref Tox Control Chart
NOEC_S with +/- 2SD
NOEC-S (g/L KCl)
1.2
1
0.8
0.6
0.4
0.2
0
02/20/02NL
04/09/02P
5/25/02P
06/12/02P
10/08/02P
12/03/02P
01/23/03P
02/19/03P^
04/01/03P
06/10/03P
08/12/03P
10/21/03P
12/09/03P
02/18/04P
03/16/04P
04/28/04M
06/15/04P
07/27/04P*
09/16/04P
11/04/04P
Test Date
NOEC-S
CUM Mean
+2SD
-2SD



Ref Tox Control Chart
NOEC_G with +/- 2SD
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Y-Axis
02/20/02NL
04/09/02P
5/25/02P
06/12/02P*
10/08/02P*
12/03/02P
01/23/03P
02/19/03P
04/01/03P
06/10/03P
08/12/03P
10/21/03P
12/09/03P
02/18/04P
03/16/04P
04/28/04M
06/15/04P
07/27/04P*
09/16/04P
11/04/04P
Test Date
NOEC-G
Cum mean
+2SD
-2SD


P. promelas 7-Day IC25-Growth Ref. Tox. Control Chart
IC25-Growth (g/L KCl)
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
02/20/02NL
04/09/02P
5/25/02P
06/12/02P
10/08/02P
12/03/02P
01/23/03P
02/19/03P
04/01/03P
06/10/03P
08/12/03P
10/21/03P
12/09/03P
02/18/04P
03/16/04P
04/28/04M
06/15/04P!
07/27/04P
09/16/04P
11/04/04P
Test Date
IC25-Growth
Cum. Mean
Mean+2SD
Mean-2SD

Appendix F

Surface Water Analytical Data

Appendix F: Surface water analytical data
Grove Pond, Plow Shop Pond, and Flannagan Pond
Fort Devens Superfund Site
Ayer, Massachusetts

Sample Name	Grove-SW-1	Grove-SW-2	Grove-SW-2 (DUP)	Grove-SW-3	Grove-SW-4	Grove-SW-5	Grove-SW-6	Plow-SW-1	Plow-SW-2	Plow-SW-3	Plow-SW-4	Plow-SW-5	Plow-SW-6	Flan-SW-1
Laboratory Sample ID	56312	56313	56325	56314	56315	56316	56317	56318	56319	56320	56321	56322	56323	56324
Sampling date	11/3/2004	11/3/2004	11/3/2004	11/3/2004	11/3/2004	11/3/2004	11/3/2004	11/3/2004	11/3/2004	11/3/2004	11/3/2004	11/3/2004	11/3/2004	11/3/2004
Total Recoverable Metals (ug/l)														
Aluminum	19 J	8 J	10 J	48 J	13 J	27 J	18 J	12 J	10 J	8 J	16 J	12 J	11 J	720 J
Antimony	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Arsenic	2.3	4.6	4.6	1.1	1.3	1.4	1.9	2	1.4	1 ND	1 ND	1 ND	1 ND	5
Barium	23	13	13	18	15	14	15	11	9.2	9.7	9.4	11	11	17
Beryllium	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Cadmium	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Calcium	27,000	21,000	21,000	17,000	12,000	11,000	12,000	12,000	11,000	10,000	10,000	10,000	10,000	7,100
Chromium	20	5 J	5 J	1 J	0.8 J	0.8 J	0.8 J	0.9 J	0.8 J	0.9 J	1	1 J	1 J	2 J
Cobalt	0.2 ND	0.2 ND	0.2 ND	0.28	0.2 ND	0.3	0.43	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.72
Copper	3 J	2 J	32	3 J	1 J	3 J	2 J	2 J	2 J	1 J	3 J	6 J	2 J	3 J
Iron	390	460 J	500	130	620	650	940	420	280	220	220	260	280	1800
Lead	2 J	0.5 J	3.4	0.4 J	0.3 J	0.6 J	0.5 J	0.3 J	0.2 J	0.2 ND	0.4 J	0.3 J	0.4 J	3.5
Magnesium	3,100	2,500	2,500	2,300	2,200	2,300	2,300	2,300	2,100	2,000	1,900	2,000	2,000	1,300
Manganese	200	600	610	57	210	180	350	34	16	27	29	91	87	310
Mercury (total)	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Molybdenum	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Nickel	1.4	1	1.2	2.5	1.1	1.6	1.3	1	0.91	0.8	1.4	0.85	0.94	1.8
Selenium	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND
Silver	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Thallium	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Vanadium	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	1.3
Zinc	6 J	5 J	8 J	8 J	8 J	8 J	7 J	3 J	9 J	4 J	6 J	8 J	7 J	13 J
Dissolved Metals (ug/l)														
Aluminum	5 ND	5 ND	5 ND	15	5 ND	6.2	6.4	5 ND	5 ND	5 ND	5 ND	5 ND	5 ND	5 ND
Antimony	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Arsenic	1.7	4	3.9	1.3	0.88	1	1.4	1.2	1	0.76	0.82	0.76	0.77	0.58
Barium	21	13	13	18	13	12	14	10	9.2	9.5	9.3	11	11	7.6
Beryllium	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Cadmium	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Calcium	27,000	21,000	21,000	16,000	11,000	12,000	12,000	11,000	11,000	10,000	10,000	10,000	10,000	6,500
Chromium	3.9	2.1	2.1	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Cobalt	0.2 ND	1.1	0.3	0.44	1.7	3.7	4	0.32	3.3	0.86	0.33	0.29	0.3	0.55
Copper	1.7	0.91	1.4	0.52	0.95	0.66	0.73	1.1	1.1	0.86	0.82	1.1	1.1	1
Iron	160	240	260	58	180	240	350	110	97	87	89	120	120	50 ND
Lead	0.39	0.22	0.24	0.2 ND	0.24	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.23	0.2 ND	0.2 ND
Magnesium	3,100	2,500	2,600	2,200	2,200	2,400	2,400	2,200	2,200	2,000	2,100	2,100	2,100	1,100
Manganese	130	540	520	46	50	120	310	28	16	15	20	78	74	6.9
Total Mercury in Water	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Molybdenum	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Nickel	1.2	0.98	0.91	1.4	1.1	1.3	1.3	0.98	0.94	0.84	0.71	0.76	0.76	0.51
Selenium	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND	1 ND
Silver	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Thallium	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND	0.5 ND
Vanadium	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND	0.2 ND
Zinc	5 ND	5 ND	5 ND	5 ND	6.3	5 ND	5 ND	5 ND	5 ND	5.3	5 ND	5 ND	5 ND	5 ND
Pesticides (ug/l)														
4,4'-DDD	0.033 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.030 ND

Appendix F: Surface water analytical data
Grove Pond, Plow Shop Pond, and Flannagan Pond
Fort Devens Superfund Site
Ayer, Massachusetts

Sample Name	Grove-SW-1	Grove-SW-2	Grove-SW-2 (DUP)	Grove-SW-3	Grove-SW-4	Grove-SW-5	Grove-SW-6	Plow-SW-1	Plow-SW-2	Plow-SW-3	Plow-SW-4	Plow-SW-5	Plow-SW-6	Flan-SW-1
Laboratory Sample ID	56312	56313	56325	56314	56315	56316	56317	56318	56319	56320	56321	56322	56323	56324
Sampling date	11/3/2004	11/3/2004	11/3/2004	11/3/2004	11/3/2004	11/3/2004	11/3/2004	11/3/2004	11/3/2004	11/3/2004	11/3/2004	11/3/2004	11/3/2004	11/3/2004
4,4'-DDE	0.033 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.030 ND
4,4'-DDT	0.036 ND	0.031 ND	0.031 ND	0.031 ND	0.031 ND	0.031 ND	0.031 ND	0.031 ND	0.031 ND	0.031 ND	0.031 ND	0.031 ND	0.031 ND	0.034 ND
Aldrin	0.065 ND	0.055 ND	0.055 ND	0.055 ND	0.055 ND	0.055 ND	0.055 ND	0.055 ND	0.055 ND	0.055 ND	0.055 ND	0.055 ND	0.055 ND	0.060 ND
Alpha Chlordane	0.033 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.030 ND
Alpha-BHC	0.033 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.030 ND
Beta-BHC	0.033 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.030 ND
Delta-BHC	0.033 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.030 ND
Dieldrin	0.033 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.030 ND
Endosulfan I	0.033 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.030 ND
Endosulfan II	0.033 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.030 ND
Endosulfan Sulfate	0.033 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.030 ND
Endrin	0.033 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.030 ND
Endrin Aldehyde	0.033 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.030 ND
Endrin Ketone	0.033 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.030 ND
Gamma Chlordane	0.033 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.030 ND
Gamma-BHC	0.033 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.030 ND
Heptachlor	0.036 ND	0.031 ND	0.031 ND	0.031 ND	0.031 ND	0.031 ND	0.031 ND	0.031 ND	0.031 ND	0.031 ND	0.031 ND	0.031 ND	0.031 ND	0.034 ND
Heptachlor Epoxide	0.033 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.030 ND
Methoxychlor	0.033 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.028 ND	0.030 ND
Technical Chlordane	0.650 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.600 ND
Toxaphene	0.650 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.600 ND
Polychlorinated biphenyls (ug/l)														
Aroclor-1016	0.650 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.600 ND
Aroclor-1221	0.650 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.600 ND
Aroclor-1232	0.650 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.600 ND
Aroclor-1242	0.650 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.600 ND
Aroclor-1248	0.650 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.600 ND
Aroclor-1254	0.650 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.600 ND
Aroclor-1260	0.650 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.600 ND
Aroclor-1262	0.650 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.600 ND
Aroclor-1268	0.650 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.550 ND	0.600 ND
ND = non detected														
ND values represent reporting limits														

Appendix G

Latitude and Longitude Values for Sample Locations

Surface Water Sampling Location Latitude and Longitude Values for Grove, Plow Shop and Flannagan Ponds

Fort Devens Superfund Site
Ayer, Massachusetts

Sample Location	Latitude	Longitude
G1	42.554995	-71.587915
G2	42.555018	-71.589177
G3	42.550927	-71.588831
G4	42.553542	-71.584859
G5	42.552267	-71.581585
G6	42.552514	-71.580218
PS1	42.555340	-71.594269
PS2	42.554710	-71.594117
PS3	42.553738	-71.591770
PS4	42.553919	-71.591386
PS5	42.556271	-71.590910
PS6	42.557660	-71.590819
F1	42.558017	-71.572584

G - Grove Pond

PS - Plow Shop Pond

F - Flannagan Pond

KECKLER
31 MAY 05

TOXICITY TESTING RESULTS USING SEDIMENT SAMPLES FROM GROVE, PLOW SHOP AND FLANNAGAN PONDS THE FORT DEVENS SUPERFUND SITE AYER, MASSACHUSETTS

Submitted to the:

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TDF No. 1440I
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Table of Contents

1.0 INTRODUCTION

This report describes the results of two rounds of sediment toxicity tests performed on composite samples collected from eleven locations in Plow Shop Pond (PS-1 through PS-11), and three locations in Grove Pond (G-1 through G-3). Both ponds are located in the vicinity of the Fort Devens Superfund Site in Ayer, Massachusetts and may potentially be impacted by the closed Shepley's Hill Landfill to the east of Plow Shop Pond, a former railroad roundhouse on the eastern bank of Plow Shop Pond, and a former tannery on the north-west corner of Grove Pond. A background composite sample was collected from Flannagan Pond, located upgradient from Grove Pond, as a reference location (F-1). These sediment toxicity tests were performed to evaluate the potential impact on benthic (sediment-dwelling) organisms resulting from exposure to contamination originating from the landfill, former railroad roundhouse, and former tannery.

The sediment samples from Plow Shop Pond were collected on February 1, 2005, and those from Grove Pond and Flannagan Pond were collected on February 2, 2005 by members of ESAT and EPA. The samples were delivered to the EPA Office of Ecosystem Management and Evaluation (OEME) facility in North Chelmsford, Massachusetts on the day of collection. Sediment samples to be analyzed for AVS/SEM were delivered to Alpha Analytical in Westborough, Massachusetts on the day of collection. All sediment samples were kept at 4°C until test initiation. Separate sediment samples were submitted to the OEME chemistry laboratory for chemical analysis.

The tests consisted of 10-day exposures using two benthic invertebrate species selected to represent sensitive sediment-dwelling organisms that might be found in New England. The two species used were the midge-fly, *Chironomus tentans*, and the amphipod, *Hyallela azteca*. These test organisms are used for toxicity testing at the EPA/OEME, Biology Section Laboratory and are cultured in-house. Both species are routinely monitored for quality through a reference toxicity testing program at the EPA/OEME facility.

2.0 STUDY OBJECTIVES

Previous investigations of the ponds have indicated the presence of high levels of trace metals in sediments, including arsenic, cadmium, chromium, mercury, manganese, nickel, and zinc. Mercury is a major contaminant of concern (COC) for this site because it tends to bioconcentrate in the food chain (USEPA, 1999). The source(s) of contamination have not been determined with certainty. Potential sources include the closed Shepley's Hill Landfill to the east of Plow Shop Pond, a former railroad roundhouse on Plow Shop Pond, and a former tannery on Grove Pond. The purpose of this study was to determine if survival or growth of the test organisms exposed to site sediment differed significantly compared to the background sample. The laboratory control sample was only used to verify that the organisms were healthy and that the test passed the test acceptability criteria (TAC) specified in EPA (1994).

The measured endpoints were survival and growth. For both species, survival was determined by counting the number of live organisms at the end of the 10-day test. Growth for *C. tentans* was measured as the ash-free dry weight (AFDW) of the surviving organisms at the end of the test. For *H. azteca*, it was measured using the dry weight of the surviving organisms at the end of the test. The results from these tests will help determine if any of the potential sources of contamination are adversely affecting sediment-dwelling organisms in the ponds.

3.0 MATERIALS AND METHODS

3.1 Sample Processing

The composite sediment samples were obtained by EPA and ESAT on February 1 and 2, 2005. The sampling locations are indicated in **Figures 1** and **2** in **Appendix A**. PS-1 and PS-2 were collected from Plow Shop Pond along the shore upgradient (north east) of the landfill. PS-11 and PS-3 were collected from within Red Cove, which is downgradient of the landfill. PS-4 and PS-5 are located just outside of Red Cove. PS-8 and PS-9 were collected near the shore adjacent to the former railroad roundhouse. PS-10 was collected near the culvert that flows from Grove Shop into Plow Shop Pond. G-1 was collected near the middle of Grove Pond. G-2 was collected within the cove where Grove Pond discharges into Plow Shop Pond. G-3 was collected near the shore where the former tannery was located. Most of the sediment samples collected from Plow Shop Pond and Grove Pond contained large fractions of organic material. F1 was collected from Flannagan Pond, located upgradient from Grove Pond. Its contaminant load reflected general background conditions upstream from the two target ponds.

Sediment was collected from each location using a Petit Ponar (see **Figure 1** in **Appendix A** for sample locations and **Appendix G** for sample-specific latitudes and longitudes). The surficial (0-6") sediment was then placed into 20-liter Cubitainers with the tops removed and homogenized using dedicated plastic scoops. Sample jars to be sent to the lab for chemical analysis and larger nalgene bottles (1-4 Liter bottles) for the sediment toxicity test were filled from the Cubitainer. All jars and bottles were placed on ice and kept in coolers until delivery at the OEME facility or Alpha Analytical. Samples were held at 4°C until test initiation.

The first round of toxicity testing was started on February 8, 2005 (*C.tentans* and *H. azteca*) and ended on February 17, 2005; the second round of testing began on February 14, 2005 (*C. tentans*) and February 15, 2005 (*H. azteca*) and ended February 23, 2005, and February 24, 2005, respectively. The sediment sample jars were submitted to the OEME chemistry laboratory for analysis of metals, total organic carbon (TOC), polycyclic aromatic hydrocarbons (PAHs), pesticides, polychlorinated biphenyls (PCBs). Acid volatile sulfides/simultaneously extracted metals (AVS/SEM) were analyzed by Alpha Analytical. A summary of the sediment analytical data is provided in **Appendix F**. Chain-of-custody records are included in **Appendix B** of this report.

3.2 Toxicity Test Methods

The toxicity tests were performed according to procedures detailed in the EPA OEME Biology Section Standard Operating Procedure (SOP) Number 2.6, which describes sediment toxicity tests methods used by EPA/OEME according to EPA (2000).

Test chambers consisted of 300-ml glass beakers with Nitex-covered notched openings to allow for a flow-through system. Eight replicates per treatment were used. Each test chamber received approximately 100 ml of sediment, and 175 ml of overlying water. Artificial sediment was used for the laboratory control. Overlying water consisted of 90 mg $CaCO_3$ /liter hardness process water (HPW). Prior to starting the test, the 90 HPW was poured by hand to fill the beakers and left to sit overnight before introducing the organisms. Hardness was checked by titration with each new batch of water prepared.

Ten second-to-third instar larval stage organisms (age 11-12 days) were randomly introduced to each test chamber. The organisms were carefully pipetted, keeping each one completely submerged in water from holding tray to test chamber. Only the most healthy and active organisms were selected for the test. The organisms were maintained throughout the 10-day exposure period at 23 ± 1°C in the Sediment Toxicity Testing System (STTS) at the OEME laboratory with a 16:8 hour light/dark cycle using cool-white fluorescent lights. Water renewals occurred between 2 and 4 times daily using the automatic renewal system associated with the STTS. The number of renewals was based upon dissolved oxygen (DO) readings and discussions with the TOPO. Due to suspected high levels of mercury in the Grove 3 sediment, these replicates were kept separately in chamber 204A at 25°C with a 16:8 hour light/dark cycle using cool-white fluorescent lights. These test beakers were renewed manually twice a day. All organisms were fed once a day after the morning renewal. Each *H. azteca* replicate was fed 1.0 ml of a yeast-alfalfa-trout chow mixture (YAT). Each *C. tentans* replicate was fed 1.5 ml of 4 grams/liter TetShake (4 grams Tetramin flakes/1liter distilled deionized water).

Temperature, pH, DO, conductivity, hardness, alkalinity, and ammonia were measured in the *H. azteca* overlying water at the start of the test. Each subsequent morning throughout the exposure period, pH, temperature, and DO were measured in a composite sample of overlying water for each station (i.e., Plow Shop sediment location 1) and each test (*H. azteca* and *C. tentans*). Temperature, pH, DO, conductivity, hardness, alkalinity, and ammonia were measured in a composite sample of overlying water for each station and each test at the end of the exposure period. Water chemistry data are summarized in **Appendix C** of this report.

At the end of the 10-day exposure period, the renewal cycle was terminated and the organisms were retrieved from the sediment toxicity test vessels. The *H. azteca* were counted, rinsed, and placed on pre-dried, pre-numbered pans. The *C. tentans* were counted, rinsed, and placed on pre-muffled, pre-weighed, and pre-numbered pans. The pan number, station, species, and number of organisms recovered were recorded on laboratory bench sheets. All pans with organisms were placed in a drying oven at 70°C for 24 hours. After 24 hours, dry weights were obtained for each pan. Once dry weights were obtained for the *C. tentans*, the pans containing the test organisms were placed in a muffle furnace at 550°C for 2 hours. These pans were allowed to cool in a dessicator and then re-weighed. The tissue weight was determined as the difference between the dry weight of the pan and organisms and the ash weight of the pan and organisms. All laboratory bench sheets, and dry and ashed weight readings are included in **Appendix D**.

3.3 Statistical Analysis of Data

Statistical analyses of the survival and growth data for both tests were conducted using CETIS ® (Comprehensive Environmental Toxicity Information System) according to the EPA decision tree in EPA (2000). Survival and growth data were analyzed separately.

Data were first compiled and analyzed using the Kolmogorov-Smironov D test to check for normality of data, and Bartlett's test to check for homogeneity of variance. Data with normal distribution and homogeneous variance were analyzed using Dunnett's Multiple Comparison Test. Non-normal and/or heterogeneous data were analyzed using Steels's Many-One Rank Test.

Any data sets with samples containing a different number of replicates (i.e. one replicate was removed because it had been compromised) and had normal distribution with homogeneous variance data were analyzed using Bonferroni Adjusted t-Test. Non-normal and/or heterogeneous data were analyzed using Bonferroni Adjusted Wilcoxon Rank Sum Test. All of the statistical tests mentioned above were used when appropriate to determine if there was a significant difference between the pond samples and background sample.

The CETIS ® statistical print-outs are provided in **Appendix D**. Growth for *C. tentans* was measured as the ash-free dry weight (AFDW) of the surviving organisms at the end of the test and analyzed by calculating the average sample ash-free dry biomass. Growth for *H. azteca* was measured as dry weight and analyzed by calculating the average sample dry biomass. The *H. azteca* were not ashed since AFDW is an impractical measure due to the small mass of these organisms.

4.0 RESULTS

4.1 *Hyallela azteca* TOXICITY TEST RESULTS

The endpoints measured for *H. azteca* were survival and growth after 10 days of exposure. The survival and growth data for this species are presented in **Tables 1** through **4**.

Table 1: Fort Devens Sediment Toxicity Testing: *H. azteca* Survival - Round 1

	Laboratory Control	F-sed-1 (reference)	P-sed-1	P-sed-2	P-sed-3	P-sed-4	P-sed-5	P-sed-6	P-sed-7
Replicate	Number of Organisms Surviving at End of Test								
1	10	9	9	10	10	7	10	9	10
2	10	9	10	8	9	8	10	9	10
3	10	10	10	10	10	7	10	7	10

Table 1: Fort Devens Sediment Toxicity Testing: *H. azteca* Survival - Round 1									
	Laboratory Control	F-sed-1 (reference)	P-sed-1	P-sed-2	P-sed-3	P-sed-4	P-sed-5	P-sed-6	P-sed-7
Replicate	Number of Organisms Surviving at End of Test								
4	10	10	9	8	10	8	10	10	10
5	10	9	8	10	9	10	9	9	9
6	10	10	9	2*	9	6	9	9	9
7	10	10	7	9	10	9	9	9	9
8	10	9	10	8	9	9	8	10	9
% Survival	100%	95%	90%	90%	95%	80%	93.75%	90%	95%

* - The beaker was spilled during organism retrieval and the replicate was removed from the statistical analysis.
Note that the numbers in the table above reflect the number of organisms in the pan count and not necessarily the number of organisms actually recovered from the sediment toxicity testing beakers.

Table 2: Fort Devens Sediment Toxicity Testing: *H. azteca* Survival - Round 2									
	Laboratory Control	F-sed-1[a] (reference)	P-sed-8	P-sed-9	P-sed-10	P-sed-11	G-sed-1	G-sed-2	G-sed-3
Replicate	Number of Organisms Surviving at End of Test								
1	10	9	9	4	10	6	7	10	0**
2	10	9	10	5	9	10	11*	10	6
3	10	10	9	6	9	9	9	10	8
4	10	10	9	6	9	9	9	9	10
5	10	9	9	8	10	10	9	10	10
6	10	10	8	4	10	10	10	10	10
7	10	10	10	5	9	10	10	8	7
8	9	9	9	1	10	7	10	10	10
% Survival	98.75%	95%	91.25%	48.75%	95%	88.75%	92.5%	96.25%	87.14%

[a] – Flannagan was only tested in the first round and is repeated here for comparison.
* - 11 organisms were introduced at the beginning of the test; a value of 10 was used to calculate % survival.
** - This replicate was removed from the statistical analysis because the organisms were most likely eaten by a live damselfly larva found in the sediment sample at the end of the 10-day exposure.
Note that the numbers in the table above reflect the number of organisms in the pan count and not necessarily the number of organisms actually recovered from the sediment toxicity testing beakers.

The minimum acceptable survival for this test is 80% as specified in EPA (2000). Survival in the laboratory control was 100% in round 1 and 98.75% in round 2, both of which met the test acceptance criteria (TAC) listed in EPA (2000). Survival in the background sample was 95%, which exceeded the minimum acceptable survival threshold of 80%. Survival in the sediment samples from Plow Shop Pond and Grove Pond were above 80% except for Plow Shop-9, in which survival equaled 48.75%. The low survival in replicate 1 of Grove-3 was attributed to the presence of a live damselfly larva found in this replicate, which likely consumed all of the test organisms during the 10-day exposure period.

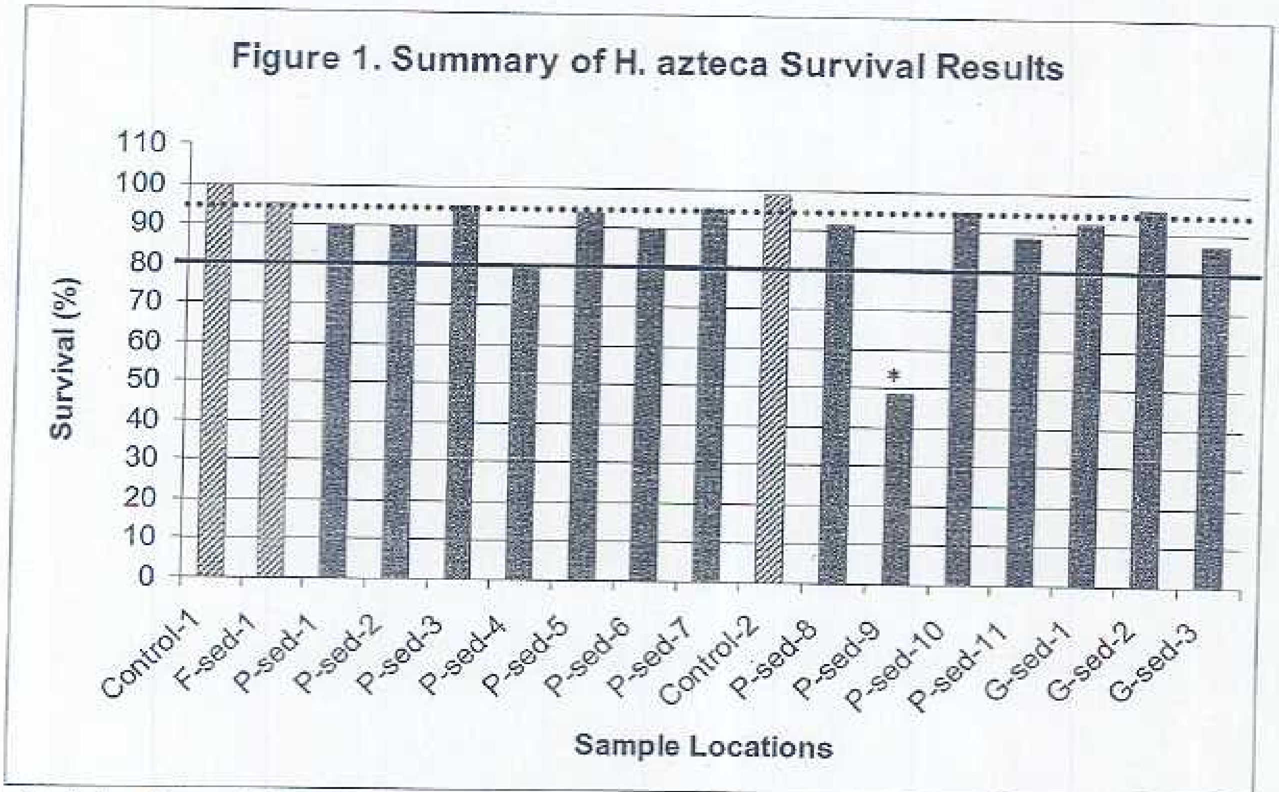
Table 3: Fort Devens Sediment Toxicity Testing: *H. azteca* Biomass - Round 1									
Replicate [b]	Laboratory Control	F-sed-1 (reference)	P-sed-1	P-sed-2	P-sed-3	P-sed-4	P-sed-5	P-sed-6	P-sed-7
1	0.085	0.148	0.104	0.075	0.089	0.069	0.116	0.098	0.090
2	0.112	0.100	0.088	0.063	0.078	0.078	0.087	0.116	0.103
3	0.098	0.117	0.059	0.083	0.070	0.050	0.119	0.047	0.094
4	0.134	0.090	0.032	0.068	0.080	0.076	0.108	0.099	0.134
5	0.092	0.133	0.052	0.103	0.058	0.074	0.085	0.089	0.098
6	0.084	0.079	0.101	NA	0.064	0.061	0.074	0.097	0.100
7	0.146	0.136	0.086	0.068	0.095	0.065	0.097	0.088	0.069
8	0.068	0.083	0.120	0.063	0.064	0.048	0.096	0.084	0.112
Average Sample Dry Biomass (mg) [c]	0.102	0.111	0.080	0.075	0.075	0.065	0.098	0.090	0.100

[b] the replicate dry biomass = measured dry weight ÷ number of organisms exposed
[c] the average sample dry biomass = the sum of the replicate dry biomass ÷ number of replicates

Table 4: Fort Devens Sediment Toxicity Testing: *H. azteca* Biomass - Round 2									
Replicate [b]	Laboratory Control	F-sed-1 [a] (reference)	P-sed-8	P-sed-9	P-sed-10	P-sed-11	G-sed-1	G-sed-2	G-sed-3
1	0.090	0.148	0.086	0.028	0.097	0.041	0.045	0.129	NA
2	0.077	0.100	0.093	0.023	0.082	0.083	0.077	0.093	0.064
3	0.064	0.117	0.083	0.040	0.069	0.062	0.082	0.108	0.069
4	0.116	0.090	0.158	0.039	0.076	0.085	0.088	0.107	0.079
5	0.079	0.133	0.095	0.073	0.087	0.084	0.074	0.104	0.065
6	0.086	0.079	0.090	0.027	0.122	0.095	0.173	0.110	0.082
7	0.061	0.136	0.117	0.022	0.114	0.110	0.082	0.070	0.049
8	0.061	0.083	0.087	0.009	0.089	0.062	0.099	0.094	0.082
Average Sample Dry Biomass (mg) [c]	0.079	0.111	0.101	0.033	0.092	0.078	0.090	0.102	0.070

[a] – Flannagan was only tested in the first round and is repeated here for comparison.
[b] the replicate dry biomass = measured dry weight ÷ number of organisms exposed
[c] the average sample dry biomass = the sum of the replicate dry biomass ÷ number of replicates

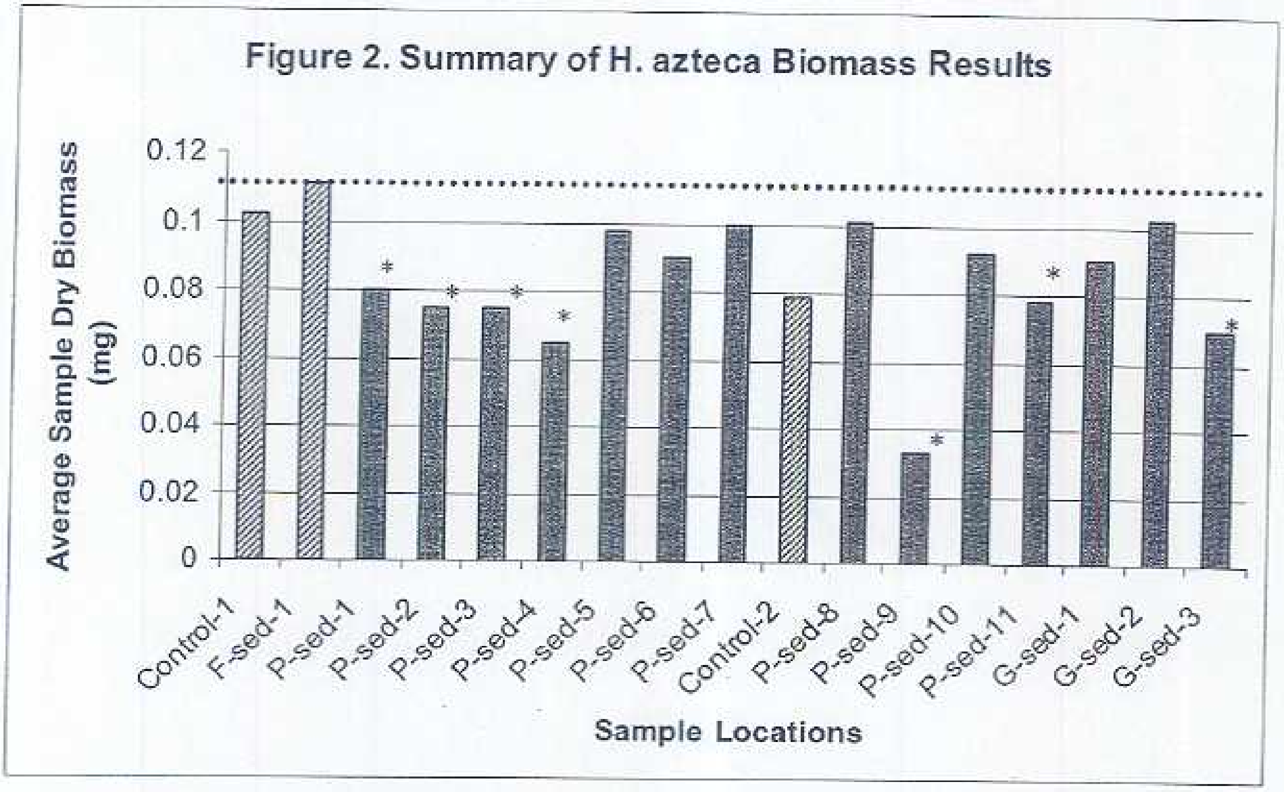
The growth data met test acceptability criteria, which required that the controls have measurable growth during the test. The Bonferroni Adjusted Wilcoxon Rank Sum Test and Bonferroni Adjusted t-Test were used determine whether survival and biomass in the Plow Shop Pond and Grove Pond samples differed significantly from the background sample. The statistical analysis found that survival was significantly reduced only in Plow Shop-9. Statistical analysis of growth showed a significant responsein Plow Shop-1, Plow Shop-2, Plow Shop-3, and Plow Shop-4, Plow Shop-9, Plow Shop-11, and Grove-3. The results of the statistical analyses on growth and survival are summarized in **Figures 1** and **2** (see also **Appendix D**).



* - Survival results were significantly different compared to the background sample (F-1)

······· Background sample reference line

—— Minimum test acceptability criteria reference line for the laboratory control sample



* - Growth results were significantly different compared to the background sample (F-1)
······· Background sample reference line

4.2 *Chironomus tentans* TOXICITY TEST RESULTS

The *C. tentans* test endpoints were survival and growth after 10 days of exposure. The results were used to determine if the percent survival and the mean organism weight at the end of the test differed between the background sample and the pond samples. The *C. tentans* survival data are presented in **Tables 5** and **6** below.

Table 5. Fort Devens Sediment Toxicity Testing: *C. tentans* Survival - Round 1									
	Laboratory Control	F-sed-1 (reference)	P-sed-1	P-sed-2	P-sed-3	P-sed-4	P-sed-5	P-sed-6	P-sed-7
Replicate	Number of Organisms Surviving at End of Test								
1	8	10	9	10	8	10	9	10	9
2	10	10	10	11*	10	10	10	10	10
3	10	10	10	10	10	9	9	10	11*
4	9	10	11*	10	10	10	9	10	10
5	9	10	10	10	10	10	10	10	10
6	9	10	10	10	10	10	10	8	10
7	9	10	10	10	10	10	8	10	9
8	10	10	10	10	10	10	10	10	10
% Survival	92.5%	100%	98.75%	100%	97.5%	98.75%	93.75%	97.5%	97.5%

* – The test replicate received additional test organisms during organism introduction; a value of 10 was used to calculate % survival

Table 6. Fort Devens Sediment Toxicity Testing: *C. tentans* Survival - Round 2[a]									
	Laboratory Control	F-sed-1[a] (reference)	P-sed-8	P-sed-9	P-sed-10	P-sed-11	G-sed-1	G-sed-2	G-sed-3
Replicate	Number of Organisms Surviving at End of Test								
1	8	10	10	3	10	10	8	10	10
2	10	10	10	4	9	8	10	10	9
3	9	10	9	6	10	8	9	10	8
4	9	10	10	2	8	9	9	10	10
5	7	10	8	3	10	10	10	9	10
6	7	10	8	8	12*	9	10	20*	10
7	9	10	9	7	9	10	9	10	12*
8	9	10	9	3	10	8	9	10	10
% Survival	85%	100%	91.25%	45%	95%	90%	92.5%	98.75%	96.25%

* – The test replicate received additional test organisms during organism introduction; a value of 10 was used to calculate % survival
[a] – Flannagan was only tested in the first round and is repeated here for comparison.

The *C. tentans* test met the survival threshold of 70% for the laboratory control as specified in EPA (2000). The data for the *C. tentans* test were evaluated using Steel's One-Many Rank Test. Plow Shop-9 was the only location where survival was found to be significantly impaired when compared to survival in the background sample.

The *C. tentans* growth data are presented in **Tables 7** and **8** below.

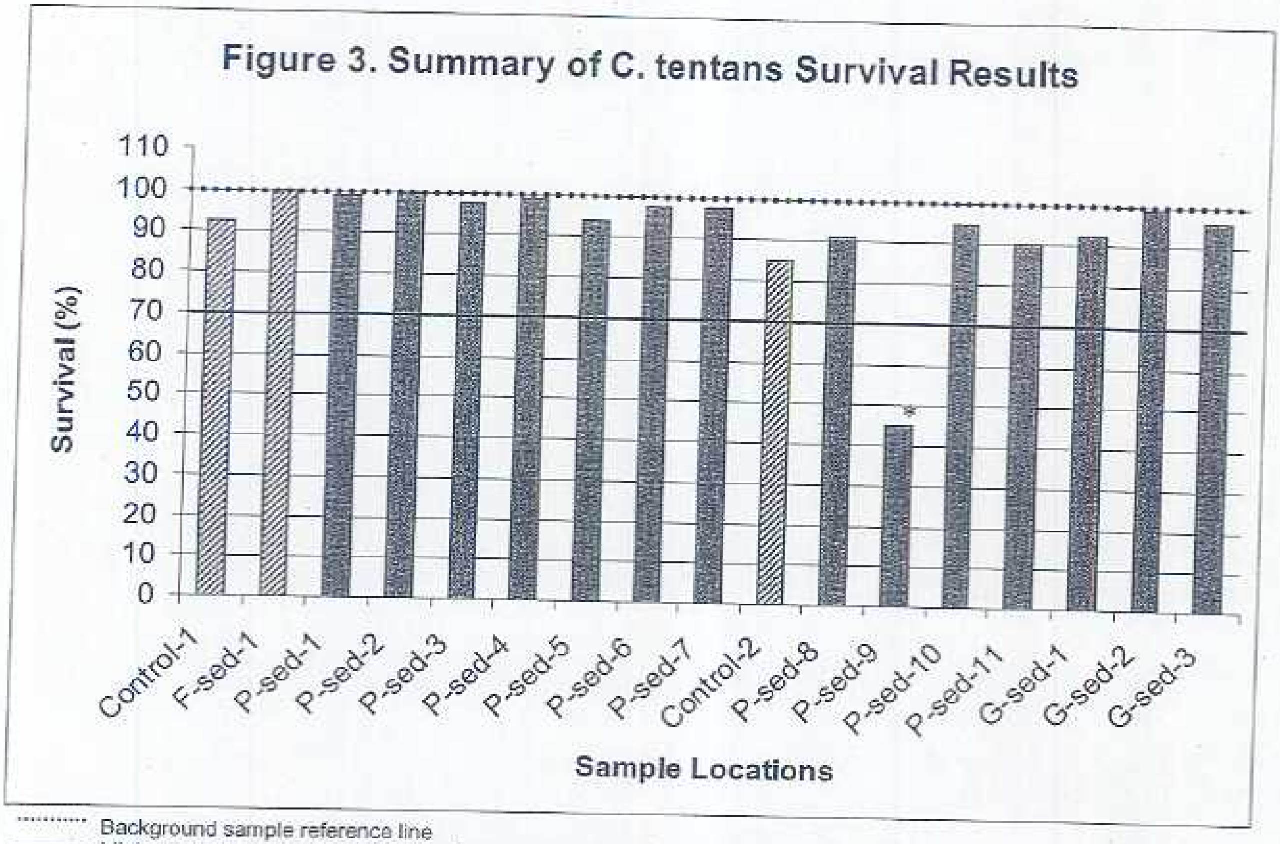
Table 7: Fort Devens Sediment Toxicity Testing: *C. tentans* Biomass - Round 1									
	Laboratory Control	F-sed-1 (reference)	P-sed-1	P-sed-2	P-sed-3	P-sed-4	P-sed-5	P-sed-6	P-sed-7
Replicate [b]									
1	1.137	0.893	1.073	0.979	1.049	1.331	1.185	1.207	0.940
2	1.133	0.957	1.158	1.061	0.902	1.224	1.187	1.064	1.180
3	1.331	1.045	1.221	0.969	1.049	1.213	1.099	1.361	1.360
4	1.248	0.884	1.035	1.057	1.212	1.350	1.087	1.314	1.300
5	1.259	0.915	1.047	0.802	0.954	1.193	1.157	1.055	1.110
6	1.113	0.786	1.096	0.999	1.232	1.400	1.119	0.993	1.215
7	1.267	0.988	1.035	1.148	1.056	1.318	1.023	1.284	1.221
8	1.416	1.130	1.049	1.067	1.052	1.344	1.162	1.388	1.105
Average Sample AFDB (mg) [c]	1.238	0.950	1.089	1.010	1.063	1.297	1.127	1.208	1.179

AFDB = ash-free dry biomass
AFDW = ash-free dry weight
[b] = the replicate AFDB = measured AFDW ÷ number of organisms exposed
[c] = the average sample AFDB = the sum of the replicate AFDBs ÷ number of replicates

Table 8: Fort Devens Sediment Toxicity Testing: *C. tentans* Biomass - Round 2									
	Laboratory Control	F-sed-1[a] (reference)	P-sed-8	P-sed-9	P-sed-10	P-sed-11	G-sed-1	G-sed-2	G-sed-3
Replicate [b]									
1	0.793	0.893	0.967	0.044	0.814	0.802	0.773	0.779	0.996
2	1.192	0.957	0.816	0.071	0.955	1.013	0.831	0.838	0.812
3	0.969	1.045	0.857	0.153	0.965	0.849	0.815	0.887	0.723
4	0.903	0.884	0.700	0.020	0.866	1.069	1.049	0.815	1.041
5	0.805	0.915	0.842	0.034	1.133	1.188	1.154	0.917	0.855
6	0.922	0.786	0.753	0.119	1.106	0.963	0.807	0.622	0.988
7	0.999	0.988	0.898	0.145	0.782	0.991	0.861	0.873	0.800
8	0.856	1.130	0.842	0.073	1.180	1.152	1.134	0.750	0.887
Average Sample AFDB (mg) [c]	0.930	0.950	0.834	0.082	0.975	1.003	0.928	0.810	0.888

AFDB = ash-free dry biomass
AFDW = ash-free dry weight
[a] – Flannagan was only tested in the first round and is repeated here for comparison.
[b] = the replicate AFDB = measured AFDW ÷ number of organisms exposed
[c] = the average sample AFDB = the sum of the replicate AFDBs ÷ number of replicates

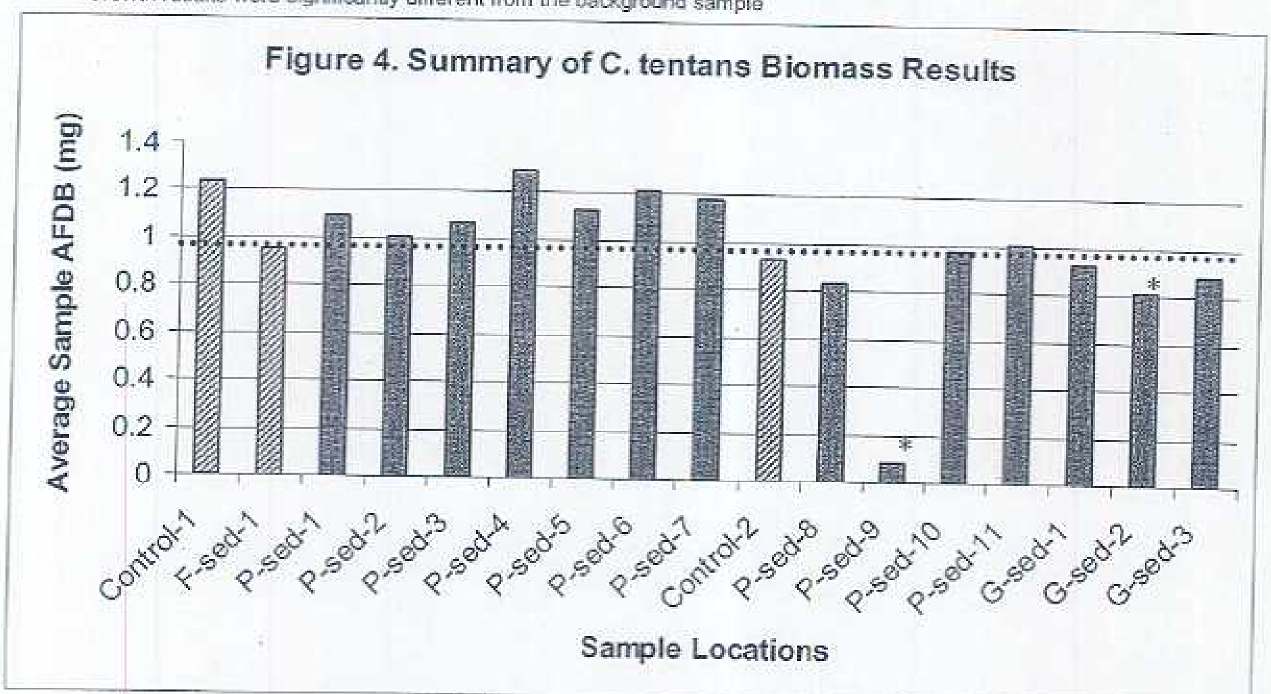
EPA (2000) stipulates a minimum mean weight of 0.48 mg AFDW per surviving control organism as a test acceptability criterion. This criterion was met and exceeded at all sampling location, except Plow Shop-9. The growth data were evaluated using Dunnett's Multiple Comparison Test to determine if growth in the Plow Shop Pond and Grove Pond samples was significantly different from the background sample. A significant growth reduction was observed only in Plow Shop Pond-9. In addition, a significant effect on *C. tentans* biomass was detected at Grove-2. However, this difference was barely significant (statistic = 2.408, critical value = 2.394). The results of the statistical analyses are summarized in **Figures 3** and **4** (see also **Appendix D**).



.... Background sample reference line

——— Minimum test acceptability criteria reference line for the laboratory control sample

* - Growth results were significantly different from the background sample



.... Background sample reference line

* - Growth results were significantly different from the background sample

5.0 DISCUSSION AND CONCLUSIONS

The controls in the *H. azteca* and *C. tentans* toxicity tests met acceptability criteria for survival and growth. The *H. azteca* and *C. tentans* toxicity tests both showed that survival and growth at Plow Shop-9 were significantly reduced compared to the background sample (Flannagan-1). This finding was consistent with laboratory observations, including a fuel smell and sheen on the Plow Shop-9 replicates and also sediment avoidance behavior by the *C. tentans* noted in this sample. The *H. azteca* toxicity test also showed significant reduction in growth at Plow Shop locations 1, 2, 3, 4, and 11 and at Grove-3. In addition, a significant effect on *C. tentans* biomass was detected at Grove-2. However, this difference was barely significant (statistic = 2.408, critical value = 2.394).

In conclusion, the evidence indicated that there was toxicity at Plow Shop-9 with respect to survival and growth in both test species. The *H. azteca* toxicity test also showed the presence of toxicity at several Plow Shop locations associated with Shepley's Hill Landfill and Red Cove. The Grove 3 location in Grove Pond is associated with the former tannery also showed the presence of toxicity. Finally, growth in *C. tentans* was reduced at Grove-2. The reason for this response is not known since Grove-2 is in the middle of Grove Pond and not associated with historical releases. Ammonia was not a major factor affecting toxicity for either species. All ammonia data were less than 5.5 ppm for both species.

6.0 REFERENCES

U. S. Environmental Protection Agency. 2000. Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Second Edition, EPA/600/R-99/064, March, 2000.

CETIS v1.0.25b. Tidepool Scientific Software. Copyright 2001-2004. Michael A. Ives.

U.S. Environment Protection Agency. 1999. Screening-Level Ecological Risk Assessment - Fort Devens. April 19, 1999.

Appendix A

Sediment Sampling Stations

Figure 1. Plow Shop and Grove Pond Sediment Sample Locations

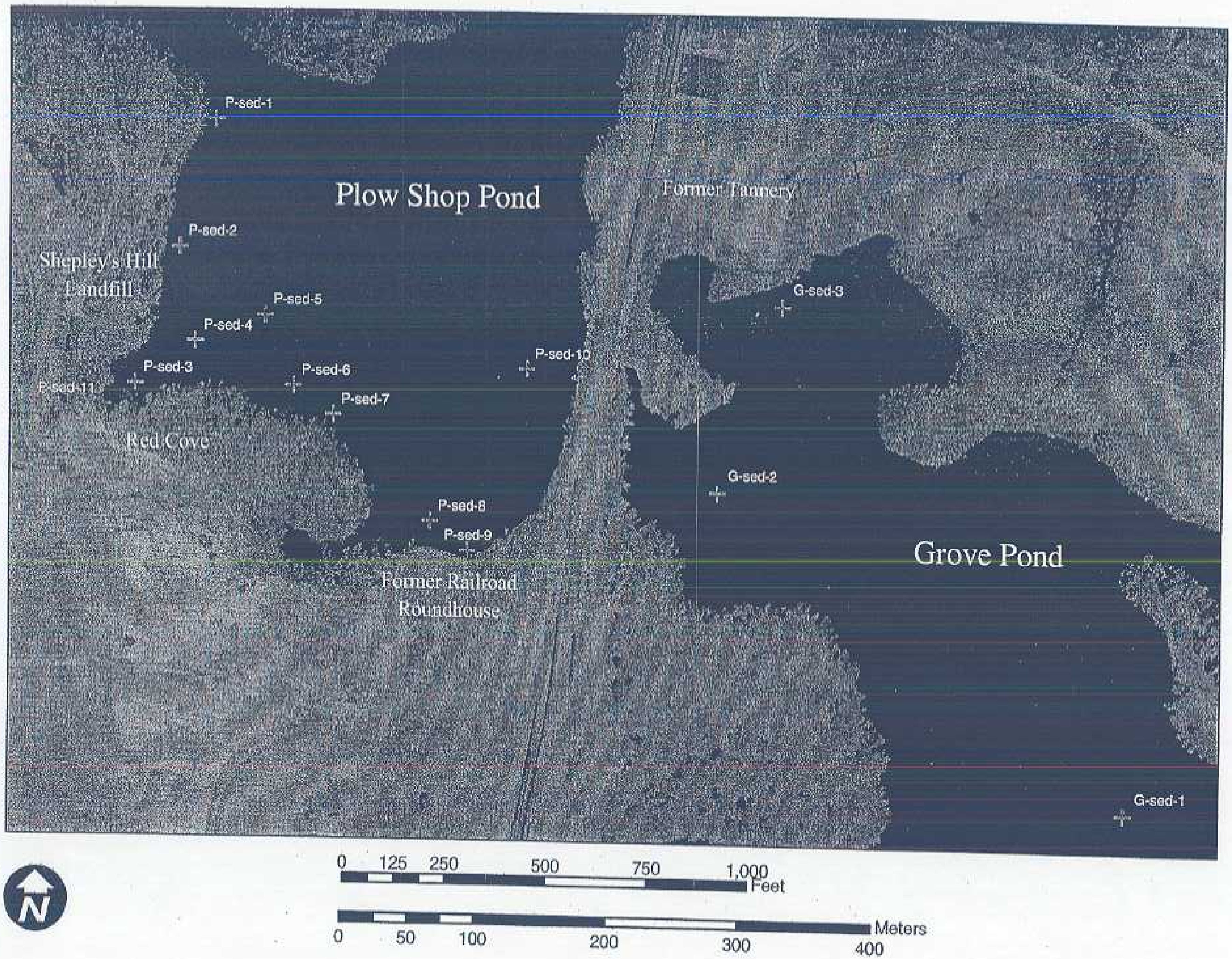
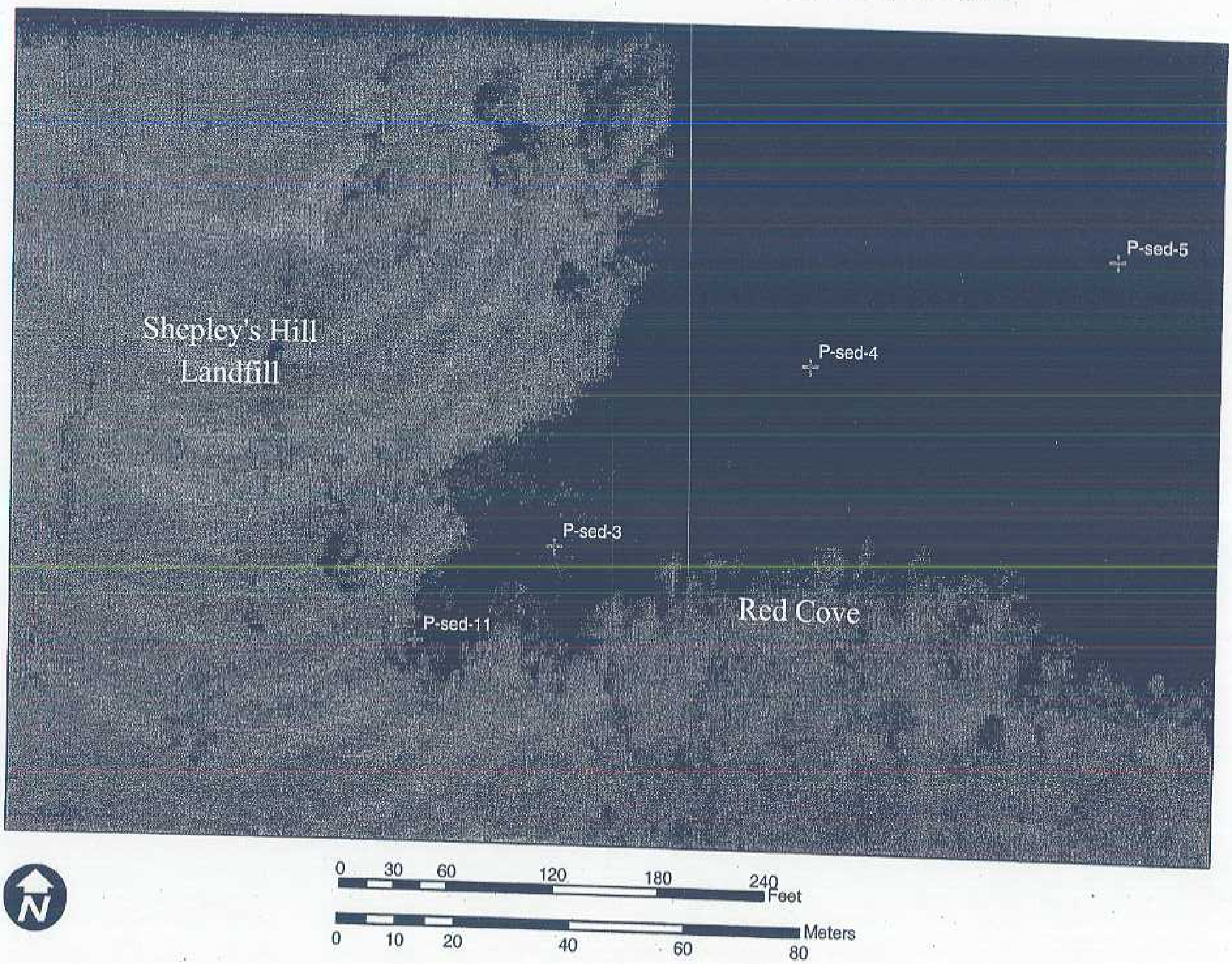


Figure 2. Plow Shop Pond Red Cove Sediment Sample Locations



Appendix B

Chain of Custody Records

EPA Region 1 / ESAT - Lockheed Martin
11 Technology Drive, North Chelmsford MA 01483
Phone (617) 918-8681

CHAIN OF CUSTODY DOCUMENT

Project Name: Fort Devens
Project No.:
Project Manager: Bart Hoskins
Field Team: *Bart Hoskins, Stan Pauwels, Mike Ferrier, Rayann Richard, Eugene Wafo*

Item	Station Number	Date	Time	Comp.	Station Location	No. of Containers	Tox/Sed Testing	ESAT Metals/Mercury	PEST/PCB	PAH	TOC
1		02/01/05	16:15	x	Plow-Sed-1	7	3	1	1	1	1
2		02/01/05	15:15	x	Plow-Sed-2	7	3	1	1	1	1
3		02/01/05	14:40	x	Plow-Sed-3	7	3	1	1	1	1
4		02/01/05	14:15	x	Plow-Sed-4	7	3	1	1	1	1
5		02/01/05	13:25	x	Plow-Sed-5	7	3	1	1	1	1
6		02/01/05	13:15	x	Plow-Sed-6	7	3	1	1	1	1
7		02/01/05	12:55	x	Plow-Sed-7	7	3	1	1	1	1
8		02/01/05	11:30	x	Plow-Sed-8	7	3	1	1	1	1
9		02/01/05	11:20	x	Plow-Sed-9	7	3	1	1	1	1
10		02/01/05	12:00	x	Plow-Sed-10	7	3	1	1	1	1
11		02/01/05	15:00	x	Plow-Sed-11	7	3	1	1	1	1
12		02/01/05	13:25	x	Plow-Sed-5 (DUP)	4	—	1	1	1	1
13											
14		02/02/05	11:30	x	Grove-Sed-1	6	2	1	1	1	1
15		02/02/05	12:03	x	Grove-Sed-2	6	2	1	1	1	1
16		02/02/05	12:40	x	Grove-Sed-3	6	2	1	1	1	1
17		02/02/05	12:40	x	Grove-Sed-3 (DUP)	4	—	1	1	1	1
18											
19		02/02/05	14:10	x	Flan-Sed-1	8	4	1	1	1	1
20											
21		02/01/05	14:00		Plow-Rinsate Blank	4	—	2	2	—	—
22		02/02/05	12:20		Grove-Rinsate Blank	2	—	1	1	—	—

Relinquished by (Print Name): Rayann Richard	Date: 2/3/05	Relinquished by (Print Name):	Date:
Signature: [signature]	Time: 9:00 AM	Signature:	Time:
Received by Lab (Print Name):	Date:	Received by Lab (Print Name):	Date: 02/03/05
Signature:	Time:	Signature: [signature] ESAT	Time: 9:00

REGION 1

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
	Fort Devens, Ayer, MA

SAMPLERS: *(Signature)* [signature]

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	AVS/SEM						REMARKS
	2/2/05	11:30			Grove-SED-1	1	✓						
	2/2/05	12:03			Grove-SED-2	1	✓						
	2/2/05	12:40			Grove-SED-3	1	✓						
	2/2/05	12:40			Grove-SED-3 Dup	1	✓						
	2/2/05	2:10			Flan-SED-1	1	✓						

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
[signature]	2/2/05 1525	[signature] 2/2 1525			
Relinquished by: *(Signature)*	**Date / Time**	**Received by:** *(Signature)*	**Relinquished by:** *(Signature)*	**Date / Time**	**Received by:** *(Signature)*
Relinquished by: *(Signature)*	**Date / Time**	**Received for Laboratory by:** *(Signature)*	**Date / Time**	**Remarks**	

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

REGION 1

CHAIN OF CUSTODY RECORD

14 14572

PROJ. NO.

PROJECT NAME: Fort Devens

SAMPLERS: (Signature) [signature] Mike Ferrity, Stan Pawnals, Eugene wato, Rayann Richard

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	AVS/SEM					REMARKS
	2/1/05	4:15			Plow-SED-1	1	✓					
	2/1/05	3:15			Plow-SED-2	1	✓					
	2/1/05	2:40			Plow-SED-3	1	✓					
	2/1/05	2:15			Plow-SED-4	1	✓					
	2/1/05	1:25			Plow-SED-5	1	✓					
	2/1/05	1:15			Plow-SED-6	1	✓					
	2/1/05	12:55			Plow-SED-7	1	✓					
	2/1/05	11:30			Plow-SED-8	1	✓					
	2/1/05	11:20			Plow-SED-9	1	✓					
	2/1/05	12:00			Plow-SED-10	1	✓					
	2/1/05	3:00			Plow-SED-11	1	✓					
	2/1/05	1:25			Plow-SED-5 DUP	1	✓					

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
[signature]	2/1/05 1835	[signature]	2-1-05 1835		
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

Appendix C

Toxicity Test Chemistry Summary

Chemistry Data for the *Hyallela azteca* Sediment Toxicity 10 day Exposure Test

H. azteca 10 day Exposure Test - Round 1
Initial Chemistry - Day 0 (2/7/05)

Sample ID	DO (mg/L)	pH	Temp (°C)	Conductivity (µmhos/cm)*	Alkalinity (mg/L as $CaCO_3$)	Hardness (mg/L as $CaCO_3$)	Total Ammonia (ppm NH_3) [a]
Plow-SED-1	5.29	6.72	21.88	247	24	52	0.37
Plow-SED-2	4.75	6.85	21.53	282	49.5	68	2.6
Plow-SED-3	5.61	6.92	21.53	249	65.5	68	2.2
Plow-SED-4	4.33	6.77	21.77	269	63.5	80	1.8
Plow-SED-5	6.13	6.84	21.56	275	52.5	62	1.4
Plow-SED-6	7.10	7.18	21.81	285	63	84	1.6
Plow-SED-7	7.11 [b]	7.17	21.77	290	68	92	1.2
Flan-SED-1	4.96	6.69	21.70	215	35.5	52	0.75
Control	8.01	7.92	21.90	311	71	84	0.47

The control consisted of artificial sediment
*- 1 microsiemen/cm (µS/cm) = 1 micromho/cm (µmho/cm)
[a] - Total ammonia was performed on inital C. tentans overlying water and is repeated here.
[b] - Red toggle switch accidentally turned on, and then immediately turned off but high DO may have resulted

H. azteca 10 day Exposure Test - Round 1
Waste Water Chemistry - Day 1 (2/9/05)

Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-1	5.97	6.96	22.25
Plow-SED-2	5.68	7.07	21.64
Plow-SED-3	6.36	7.26	21.55
Plow-SED-4	5.84	7.06	21.56
Plow-SED-5	6.64	7.24	21.63
Plow-SED-6	7.03	7.41	21.60
Plow-SED-7	6.82	7.44	21.64
Flan-SED-1	7.22	7.56	21.60
Control	7.35	7.83	21.65

H. azteca 10 day Exposure Test - Round 1 Waste Water Chemistry - Day 2 (2/10/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-1	6.50	7.35	22.07
Plow-SED-2	6.17	7.22	22.10
Plow-SED-3	6.56	7.33	22.02
Plow-SED-4	6.26	7.11	22.07
Plow-SED-5	7.02	7.35	21.98
Plow-SED-6	6.90	7.48	21.93
Plow-SED-7	7.35	7.48	22.02
Flan-SED-1	7.54	7.66	22.06
Control	7.53	7.93	21.98

H. azteca 10 day Exposure Test - Round 1 Waste Water Chemistry - Day 3 (2/11/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-1	7.01	7.59	22.11
Plow-SED-2	7.00	7.48	22.03
Plow-SED-3	6.92	7.47	22.18
Plow-SED-4	7.12	7.37	22.15
Plow-SED-5	7.33	7.50	22.15
Plow-SED-6	7.27	7.61	22.11
Plow-SED-7	7.25	7.54	22.06
Flan-SED-1	7.49	7.71	22.08
Control	7.03	7.70	22.06

H. azteca 10 day Exposure Test - Round 1 Waste Water Chemistry - Day 4 (2/12/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-1	6.91	7.67	22.17

H. azteca 10 day Exposure Test - Round 1
Waste Water Chemistry - Day 4 (2/12/05)

Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-2	6.80	7.55	22.17
Plow-SED-3	7.45	7.61	22.23
Plow-SED-4	6.68	7.44	22.21
Plow-SED-5	7.33	7.61	22.22
Plow-SED-6	7.55	7.71	22.20
Plow-SED-7	7.42	7.66	22.19
Flan-SED-1	7.45	7.78	22.27
Control	7.24	7.81	22.26

H. azteca 10 day Exposure Test - Round 1
Waste Water Chemistry - Day 5 (2/13/05)

Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-1	7.00	7.47	22.36
Plow-SED-2	6.95	7.50	22.20
Plow-SED-3	7.17	7.52	22.12
Plow-SED-4	6.84	7.41	22.10
Plow-SED-5	7.28	7.57	22.05
Plow-SED-6	7.02	7.68	22.13
Plow-SED-7	7.35	7.66	22.05
Flan-SED-1	7.28	7.78	22.05
Control	6.88	7.78	22.08

H. azteca 10 day Exposure Test - Round 1
Waste Water Chemistry - Day 6 (2/14/05)

Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-1	6.81	7.92	22.33
Plow-SED-2	6.80	7.85	22.15
Plow-SED-3	6.97	7.90	22.14
Plow-SED-4	6.80	7.84	22.11

H. azteca 10 day Exposure Test - Round 1 Waste Water Chemistry - Day 6 (2/14/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-5	6.89	7.88	22.11
Plow-SED-6	7.09	8.01	22.08
Plow-SED-7	6.98	7.93	22.06
Flan-SED-1	7.18	8.06	21.07
Control	6.38	7.98	21.23

H. azteca 10 day Exposure Test - Round 1 Waste Water Chemistry - Day 7 (2/15/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-1	6.78	7.66	21.95
Plow-SED-2	6.73	7.60	21.86
Plow-SED-3	7.04	7.67	21.81
Plow-SED-4	6.65	7.52	21.72
Plow-SED-5	6.86	7.67	21.85
Plow-SED-6	6.95	7.73	21.78
Plow-SED-7	6.83	7.73	21.77
Flan-SED-1	6.93	7.71	21.71
Control	6.31	7.74	21.90

H. azteca 10 day Exposure Test - Round 1 Waste Water Chemistry - Day 8 (2/16/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-1	6.58	7.64	22.30
Plow-SED-2	6.55	7.64	21.94
Plow-SED-3	6.83	7.68	21.92
Plow-SED-4	6.84	7.59	21.90
Plow-SED-5	6.71	7.70	21.93
Plow-SED-6	6.70	7.77	21.87
Plow-SED-7	7.13	7.78	21.93

H. azteca 10 day Exposure Test - Round 1 Waste Water Chemistry - Day 8 (2/16/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Flan-SED-1	6.45	7.74	22.18
Control	5.81	7.73	22.09

H. azteca 10 day Exposure Test - Round 1 Waste Water Chemistry - Day 9 (2/17/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-1	5.92	7.58	22.47
Plow-SED-2	5.98	7.61	22.18
Plow-SED-3	6.18	7.61	22.12
Plow-SED-4	6.07	7.54	22.11
Plow-SED-5	6.43	7.71	22.05
Plow-SED-6	6.20	7.77	22.14
Plow-SED-7	6.38	7.71	22.03
Flan-SED-1	6.27	7.70	21.98
Control	4.38	7.63	22.04

H. azteca 10 day Exposure Test - Round 1 Final Chemistry - Day 10 (2/18/05)							
Sample ID	DO (mg/L)	pH	Temp (°C)	Conductivity (µmhos/cm)*	Alkalinity (mg/L as $CaCO_3$)	Hardness (mg/L as $CaCO_3$)	Total Ammonia (ppm NH_3) [a]
Plow-SED-1	5.47	7.70	21.38	294	89	88	0.19
Plow-SED-2	5.52	7.73	21.40	296	90.5	100	0.76
Plow-SED-3	5.90	7.70	21.37	298	87.5	98	1.0
Plow-SED-4	5.37	7.63	21.46	297	89.5	98	1.0
Plow-SED-5	5.40	7.68	21.46	295	87	96	0.91
Plow-SED-6	5.55	7.73	21.41	297	88	98	0.88
Plow-SED-7	5.35	7.73	21.41	296	88	98	0.78

H. azteca 10 day Exposure Test - Round 1 Final Chemistry - Day 10 (2/18/05)							
Sample ID	DO (mg/L)	pH	Temp (°C)	Conductivity (µmhos/cm)*	Alkalinity (mg/L as $CaCO_3$)	Hardness (mg/L as $CaCO_3$)	Total Ammonia (ppm NH_3) [a]
Flan-SED-1	5.30	7.73	21.48	291	83.5	94	0.43
Control	4.61	7.65	21.45	311	97	106	0.36

[a] - Total Ammonia was performed on 2/25/05 due to lack of pillow packets

*- 1 microsiemen/cm (µS/cm) = 1 micromho/cm (µmho/cm)

Chemistry Data for the *Hyallela azteca* Sediment Toxicity 10 day Exposure Test

H. azteca 10 day Exposure Test -Round 2 Initial Chemistry - Day 0 (2/14/05)							
Sample ID	DO (mg/L)	pH	Temp (°C)	Conductivity (µmhos/cm)*	Alkalinity (mg/L as $CaCO_3$)	Hardness (mg/L as $CaCO_3$)	Total Ammonia (ppm NH_3) [a]
Plow-SED-8	5.22	7.10	21.98	266	54.5	60	0.74
Plow-SED-9	5.62	7.26	21.46	263	64	80	0.22
Plow-SED-10	6.29	7.40	21.41	290	61	74	0.28
Plow-SED-11	5.86	7.48	21.43	291	72	80	1.2
Grove-SED-1	4.74	8.06	21.40	355	128	124	0.30
Grove-SED-2	6.08	7.86	21.41	346	341.5	110	1.0
Grove-SED-3 [b]	5.80	8.05	25.02	607	228	184	5.5
Control	7.73	8.24	21.52	303	85	92	0.091

The control consisted of artificial sediment
*- 1 microsiemen/cm (µS/cm) = 1 micromho/cm (µmho/cm)
[a] - Total ammonia was performed on Plow-SED-10 and Grove-SED-1 on 2/25/05 due to lack of pillow packs. Ammonia values are from non-preserved samples.
[b] - Grove-SED-3 was stored in Chamber 204 for the duration of the test

H. azteca 10 day Exposure Test -Round 2 Waste Water Chemistry - Day 1 (2/16/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-8	5.78	7.55	22.29
Plow-SED-9	6.15	7.60	22.12
Plow-SED-10	5.77	7.46	22.14
Plow-SED-11	6.13	7.52	22.15
Grove-SED-1	5.82	7.99	22.15
Grove-SED-2	5.80	7.80	22.19
Grove-SED-3	6.40	8.12	22.09
Control	6.48	7.98	22.20

H. azteca 10 day Exposure Test -Round 2 Waste Water Chemistry - Day 2 (2/17/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-8	5.45	7.51	21.91
Plow-SED-9	5.73	7.53	22.04
Plow-SED-10	5.12	7.32	22.05
Plow-SED-11	5.55	7.42	21.98
Grove-SED-1	5.50	7.96	21.98
Grove-SED-2	5.50	7.73	21.99
Grove-SED-3	6.10	8.06	24.34
Control	5.81	7.89	22.25

H. azteca 10 day Exposure Test -Round 2 Waste Water Chemistry - Day 3 (2/18/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-8	5.40	7.67	21.90
Plow-SED-9	5.90	7.70	21.87
Plow-SED-10	5.46	7.52	21.93
Plow-SED-11	6.22	7.67	21.94
Grove-SED-1	6.48	8.24	21.83
Grove-SED-2	6.16	7.97	21.79
Grove-SED-3	6.28	8.14	21.81
Control	6.80	8.19	21.82

H. azteca 10 day Exposure Test -Round 2 Waste Water Chemistry - Day 4 (2/19/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-8	5.88	7.65	21.98
Plow-SED-9	6:20	7.67	21.95
Plow-SED-10	5.57	7.43	21.96
Plow-SED-11	6.07	7.59	21.96

H. azteca 10 day Exposure Test -Round 2 Waste Water Chemistry - Day 4 (2/19/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Grove-SED-1	6.64	8.15	21.95
Grove-SED-2	6.27	7.85	21.94
Grove-SED-3	5.52	7.92	21.93
Control	6.49	8.01	21.95

H. azteca 10 day Exposure Test -Round 2 Waste Water Chemistry - Day 5 (2/20/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-8	5.11	7.56	21.84
Plow-SED-9	4.87	7.55	21.85
Plow-SED-10	4.32	7.33	21.79
Plow-SED-11	5.20	7.57	21.78
Grove-SED-1	5.18	7.97	21.82
Grove-SED-2	4.73	7.68	21.80
Grove-SED-3	5.99	8.05	21.80
Control	4.23	7.67	21.79

H. azteca 10 day Exposure Test -Round 2 Waste Water Chemistry - Day 6 (2/21/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-8	5.18	7.68	21.89
Plow-SED-9	5.41	7.73	21.88
Plow-SED-10	4.83	7.50	21.84
Plow-SED-11	5.35	7.71	21.84
Grove-SED-1	5.67	8.13	21.83
Grove-SED-2	5.26	7.89	21.88
Grove-SED-3	5.89*	8.14	21.88
Control	4.93	7.82	21.8

* - Accidentally turned on red toggle switch resulting in a possibly higher DO value

H. azteca 10 day Exposure Test -Round 2 Waste Water Chemistry - Day 7 (2/22/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-8	5.64	7.55	22.40
Plow-SED-9	5.82	7.66	22.18
Plow-SED-10	5.55	7.54	22.12
Plow-SED-11	5.89	7.65	22.12
Grove-SED-1	6.12	8.13	22.07
Grove-SED-2	5.78	7.77	22.08
Grove-SED-3	5.52	8.05	22.10
Control	5.76	7.70	22.01

H. azteca 10 day Exposure Test -Round 2 Waste Water Chemistry - Day 8 (2/23/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-8	6.20	7.70	22.29
Plow-SED-9	6.26	7.77	21.95
Plow-SED-10	6.10	7.70	21.93
Plow-SED-11	6.46	7.81	21.88
Grove-SED-1	6.98	8.25	21.89
Grove-SED-2	6.34	7.93	21.86
Grove-SED-3	6.40	8.13	21.88
Control	6.34	7.79	21.95

H. azteca 10 day Exposure Test -Round 2 Waste Water Chemistry - Day 9 (2/24/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-8	6.20	7.78	22.28
Plow-SED-9	6.33	7.83	22.18
Plow-SED-10	6.14	7.73	22.17
Plow-SED-11	6.56	7.85	22.18

H. azteca 10 day Exposure Test -Round 2 Waste Water Chemistry - Day 9 (2/24/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Grove-SED-1	6.83	8.24	22.18
Grove-SED-2	6.51	7.94	22.13
Grove-SED-3	6.30	8.12	22.21
Control	5.90	7.76	22.12

H. azteca 10 day Exposure Test -Round 2 Final Chemistry - Day 10 (2/25/05)							
Sample ID	DO (mg/L)	pH	Temp (°C)	Conductivity (µmhos/cm)*	Alkalinity (mg/L as $CaCO_3$)	Hardness (mg/L as $CaCO_3$)	Total Ammonia (ppm NH_3) [a]
Plow-SED-8	5.30	7.45	22.34	298	84.5	98	0.57
Plow-SED-9	5.45	7.45	22.11	296	85	94	0.69
Plow-SED-10	5.52	7.42	22.07	293	83	90	0.66
Plow-SED-11	6.06	7.56	22.02	297	85	94	0.68
Grove-SED-1	6.19	7.95	22.03	308	91.5	100	0.72
Grove-SED-2	5.64	7.63	22.06	300	87.5	96	0.80
Grove-SED-3	5.75	7.87	22.10	399	128	130	1.9
Control	5.39	7.45	22.04	310	93.5	140	0.20

[a] - Total Ammonia was performed on 2/25/05 due to lack of pillow packets

*- 1 microsiemen/cm (µS/cm) = 1 micromho/cm (µmho/cm)

Chemistry Data for the *Chironomus tentans* Sediment Toxicity 10 day Exposure Test

C. tentans 10 day Exposure Test - Round 1
Initial Chemistry - Day 0 (2/7/05)

Sample ID	DO (mg/L)	pH	Temp (°C)	Conductivity (µmhos/cm)*	Alkalinity (mg/L as $CaCO_3$)	Hardness (mg/L as $CaCO_3$)	Total Ammonia (ppm NH_3)
Plow-SED-1	5.29	6.72	21.88	247	24	52	0.37
Plow-SED-2	4.75	6.85	21.53	282	49.5	68	2.6
Plow-SED-3	5.61	6.92	21.53	249	65.5	68	2.2
Plow-SED-4	4.33	6.77	21.77	269	63.5	80	1.8
Plow-SED-5	6.13	6.84	21.56	275	52.5	62	1.4
Plow-SED-6	7.10	7.18	21.81	285	63	84	1.6
Plow-SED-7	7.11 [a]	7.17	21.77	290	68	92	1.2
Flan-SED-1	4.96	6.69	21.70	215	35.5	52	0.75
Control	8.01	7.92	21.90	311	71	84	0.47

The control consisted of artificial sediment
*-1 microsiemen/cm (µS/cm) = 1 micromho/cm (µmho/cm)
DO, pH, Temp, Conductivity, Alkalinity and Hardness were performed on initial overlying water from *H. azteca* and are repeated here.
[a] - Red toggle switch was accidentally turned on, and then immediately turned off but high DO may have resulted

C. tentans 10 day Exposure Test - Round 1
Waste Water Chemistry - Day 1 (2/9/05)

Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-1	3.46	6.73	21.68
Plow-SED-2	3.67	6.84	21.61
Plow-SED-3	4.35	7.08	21.57
Plow-SED-4	3.93	6.87	21.55
Plow-SED-5	4.24	6.80	21.59
Plow-SED-6	4.41	7.01	21.60
Plow-SED-7	4.50	6.97	21.63
Flan-SED-1	5.17	7.11	21.63
Control	5.31	7.55	21.65

C. tentans 10 day Exposure Test - Round 1 Waste Water Chemistry - Day 2 (2/10/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-1	3.90	6.68	21.88
Plow-SED-2	3.26	6.70	21.95
Plow-SED-3	5.25	7.12	21.95
Plow-SED-4	4.59	6.86	22.04
Plow-SED-5	4.66	6.72	21.95
Plow-SED-6	5.43	7.05	21.96
Plow-SED-7	4.89	6.92	21.94
Flan-SED-1	5.90	7.09	22.09
Control	6.21	7.71	22.03

C. tentans 10 day Exposure Test - Round 1 Waste Water Chemistry - Day 3 (2/11/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-1	7.36	7.22	22.46
Plow-SED-2	6.19	7.14	22.18
Plow-SED-3	7.03	7.43	22.20
Plow-SED-4	6.62	7.24	22.24
Plow-SED-5	6.08	7.01	22.26
Plow-SED-6	7.36	7.47	22.15
Plow-SED-7	6.88	7.29	22.10
Flan-SED-1	7.12	7.44	22.04
Control	7.72	7.91	22.13

C. tentans 10 day Exposure Test - Round 1 Waste Water Chemistry - Day 4 (2/12/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-1	4.92	6.88	22.47
Plow-SED-2	4.60	6.99	22.19
Plow-SED-3	6.44	7.35	22.19

C. tentans 10 day Exposure Test - Round 1 Waste Water Chemistry - Day 4 (2/12/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-4	5.06	7.09	22.16
Plow-SED-5	5.70	7.06	22.35
Plow-SED-6	5.62	7.22	22.30
Plow-SED-7	5.83	7.27	22.17
Flan-SED-1	6.53	7.45	22.14
Control	6.58	7.79	22.22

C. tentans 10 day Exposure Test - Round 1 Waste Water Chemistry - Day 5 (2/13/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-1	4.33	7.03	22.05
Plow-SED-2	4.91	7.19	22.08
Plow-SED-3	6.55	7.49	22.01
Plow-SED-4	5.43	7.24	22.22
Plow-SED-5	5.54	7.12	22.04
Plow-SED-6	5.48	7.28	21.97
Plow-SED-7	5.68	7.30	21.97
Flan-SED-1	6.50	7.43	22.13
Control	6.60	7.78	22.02

C. tentans 10 day Exposure Test - Round 1 Waste Water Chemistry - Day 6 (2/14/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-1	5.08	7.22	21.97
Plow-SED-2	5.13	7.36	22.06
Plow-SED-3	6.71	7.77	22.01
Plow-SED-4	5.59	7.47	22.01
Plow-SED-5	5.88	7.44	22.01
Plow-SED-6	5.91	7.56	22.01

C. tentans 10 day Exposure Test - Round 1 Waste Water Chemistry - Day 6 (2/14/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-7	6.01	7.51	22.00
Flan-SED-1	6.31	7.65	22.00
Control	6.52	7.98	22.00

C. tentans 10 day Exposure Test - Round 1 Waste Water Chemistry - Day 7 (2/15/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-1	5.42	7.09	21.69
Plow-SED-2	5.43	7.20	21.67
Plow-SED-3	6.48	7.52	21.67
Plow-SED-4	5.83	7.28	21.65
Plow-SED-5	5.85	7.07	21.67
Plow-SED-6	6.17	7.37	21.70
Plow-SED-7	5.84	7.37	21.66
Flan-SED-1	6.31	7.31	21.83
Control	6.16	7.78	21.89

C. tentans 10 day Exposure Test - Round 1 Waste Water Chemistry - Day 8 (2/16/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-1	6.23	7.34	21.87
Plow-SED-2	5.66	7.29	21.82
Plow-SED-3	6.36	7.55	21.83
Plow-SED-4	5.91	7.37	21.82
Plow-SED-5	5.55	7.12	21.85
Plow-SED-6	6.44	7.48	21.83
Plow-SED-7	5.83	7.38	21.83
Flan-SED-1	5.46	7.33	21.87
Control	5.62	7.72	21.84

C. tentans 10 day Exposure Test - Round 1 Waste Water Chemistry - Day 9 (2/17/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-1	4.45	7.12	21.99
Plow-SED-2	4.56	7.18	22.01
Plow-SED-3	5.55	7.45	22.01
Plow-SED-4	4.65	7.25	22.04
Plow-SED-5	4.63	7.07	22.00
Plow-SED-6	5.09	7.29	21.98
Plow-SED-7	5.05	7.36	21.99
Flan-SED-1	4.87	7.31	21.93
Control	4.50	7.62	21.85

C. tentans 10 day Exposure Test - Round 1 Final Chemistry - Day 10 (2/18/05)							
Sample ID	DO (mg/L)	pH	Temp (°C)	Conductivity (µmhos/cm)*	Alkalinity (mg/L as $CaCO_3$)	Hardness (mg/L as $CaCO_3$)	Total Ammonia (ppm NH_3) [a]
Plow-SED-1	2.53	6.92	22.24	279	64.5	86	2
Plow-SED-2	2.11	6.99	21.72	288	72	88	1.8
Plow-SED-3	4.03	7.31	21.68	296	82.5	96	1.6
Plow-SED-4	2.51	7.14	21.66	294	79.5	96	1.5
Plow-SED-5	2.90	6.98	21.59	260	58.5	74	1.6
Plow-SED-6	2.89	7.23	21.46	281	71	86	1.6
Plow-SED-7	2.42	7.22	21.51	281	74	88	1.5
Flan-SED-1	2.80	7.26	21.55	281	73	90	1.4
Control	2.84	7.56	21.52	329	101.5	112	0.63

[a] - Total Ammonia was performed on 2/25/05 due to lack of pillow packets
*-1 microsiemen/cm (µS/cm) = 1 micromho/cm (µmho/cm)

Chemistry Data for the *Chironomus tentans* Sediment Toxicity 10 day Exposure Test

C. tentans 10 day Exposure Test - Round 2
Initial Chemistry - Day 0 (2/14/05)

Sample ID	DO (mg/L)	pH	Temp (°C)	Conductivity (µmhos/cm)*	Alkalinity (mg/L as $CaCO_3$)	Hardness (mg/L as $CaCO_3$)	Total Ammonia (ppm NH_3)
Plow-SED-8	5.22	7.10	21.98	266	54.5	60	0.74
Plow-SED-9	5.62	7.26	21.46	263	64	80	0.22
Plow-SED-10	6.29	7.40	21.41	290	61	74	0.28
Plow-SED-11	5.86	7.48	21.43	291	72	80	1.2
Grove-SED-1	4.74	8.06	21.40	355	128	124	0.30
Grove-SED-2	6.08	7.86	21.41	346	341.5	110	1.0
Grove-SED-3 [a]	5.80	8.05	25.02	607	228	184	5.5
Control	7.73	8.24	21.52	303	85	92	0.091

The control consisted of artificial sediment
DO, pH, Temp, Conductivity, Alkalinity and Hardness were performed on initial overlying water from *H. azteca* and are repeated here.
* - 1 microsiemen/cm (µS/cm) = 1 micromho/cm (µmho/cm)
[a] - Grove-SED-3 was stored in Chamber 204 for the duration of the test

C. tentans 10 day Exposure Test - Round 2
Waste Water Chemistry - Day 1 (2/15/05)

Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-8	6.52	7.38	21.90
Plow-SED-9	7.03	7.59	21.88
Plow-SED-10	6.56	7.44	21.85
Plow-SED-11	6.48	7.34	21.84
Grove-SED-1	6.75	8.06	21.86
Grove-SED-2	6.46	7.76	21.83
Grove-SED-3	5.48	7.91	24.27
Control	7.27	8.10	21.85

C. tentans 10 day Exposure Test - Round 2 Waste Water Chemistry - Day 2 (2/16/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-8	5.30	7.34	22.11
Plow-SED-9	6.25	7.60	22.10
Plow-SED-10	5.36	7.31	22.08
Plow-SED-11	5.24	7.29	22.14
Grove-SED-1	5.53	7.99	22.06
Grove-SED-2	5.26	7.70	22.13
Grove-SED-3	6.21	8.01	22.10
Control	6.14	7.95	22.12

C. tentans 10 day Exposure Test - Round 2 Waste Water Chemistry - Day 3 (2/17/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-8	3.88	7.16	21.95
Plow-SED-9	5.00	7.52	22.00
Plow-SED-10	3.88	7.08	22.03
Plow-SED-11	4.47	7.19	22.10
Grove-SED-1	3.86	7.79	21.95
Grove-SED-2	4.27	7.56	21.99
Grove-SED-3	5.51	7.91	24.50
Control	4.36	7.65	22.28

C. tentans 10 day Exposure Test - Round 2 Waste Water Chemistry - Day 4 (2/18/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-8	7.22	7.63	22.17
Plow-SED-9	7.31	7.90	22.04
Plow-SED-10	6.76	7.50	22.04
Plow-SED-11	6.77	7.52	22.03
Grove-SED-1	6.85	8.02	21.98

C. tentans 10 day Exposure Test - Round 2 Waste Water Chemistry - Day 4 (2/18/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Grove-SED-2	6.62	7.74	21.99
Grove-SED-3	6.63	8.13	22.00
Control	6.88	7.95	22.12

C. tentans 10 day Exposure Test - Round 2 Waste Water Chemistry - Day 5 (2/19/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-8	4.51	7.30	22.01
Plow-SED-9	5.94	7.74	21.95
Plow-SED-10	4.95	7.31	21.98
Plow-SED-11	4.70	7.25	21.98
Grove-SED-1	5.24	7.97	22.01
Grove-SED-2	4.65	7.65	21.97
Grove-SED-3	6.39	8.19	21.99
Control	4.95	7.77	21.94

C. tentans 10 day Exposure Test Waste Water Chemistry - Day 6 (2/20/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-8	2.83	7.01	22.32
Plow-SED-9	5.13	7.52	21.89
Plow-SED-10	3.26	7.13	21.83
Plow-SED-11	3.30	7.14	21.85
Grove-SED-1	3.89	7.90	21.82
Grove-SED-2	3.42	7.56	21.82
Grove-SED-3	4.33	7.85	21.89
Control	2.93	7.63	21.84

C. tentans 10 day Exposure Test - Round 2 Waste Water Chemistry - Day 7 (2/21/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-8	2.71	7.19	22.48
Plow-SED-9	4.21	7.61	22.04
Plow-SED-10	3.12	7.25	21.97
Plow-SED-11	2.81	7.24	21.97
Grove-SED-1	3.36	7.91	21.95
Grove-SED-2	2.65	7.58	22.02
Grove-SED-3	3.35	7.93	22.12
Control	2.22	7.68	21.95

C. tentans 10 day Exposure Test - Round 2 Waste Water Chemistry - Day 8 (2/22/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-8	4.36	7.27	21.93
Plow-SED-9	6.26	7.79	21.98
Plow-SED-10	4.68	7.34	21.92
Plow-SED-11	4.05	7.31	21.98
Grove-SED-1	5.33	8.00	22.00
Grove-SED-2	4.62	7.65	21.95
Grove-SED-3	3.89	7.81	22.01
Control	4.73	7.66	22.00

C. tentans 10 day Exposure Test - Round 2 Waste Water Chemistry - Day 9 (2/23/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Plow-SED-8	4.53	7.09	21.92
Plow-SED-9	6.23	7.62	21.97
Plow-SED-10	5.11	7.31	22.04
Plow-SED-11	3.73	7.17	22.02
Grove-SED-1	5.34	8.05	21.99

C. tentans 10 day Exposure Test - Round 2 Waste Water Chemistry - Day 9 (2/23/05)			
Sample ID	DO (mg/L)	pH	Temperature (°C)
Grove-SED-2	5.19	7.62	21.97
Grove-SED-3	4.58	7.83	21.96
Control	4.24	7.33	22.43

C. tentans 10 day Exposure Test - Round 2 Final Chemistry - Day 10 (2/24/05)							
Sample ID	DO (mg/L)	pH	Temp (°C)	Conductivity (µmhos/cm)*	Alkalinity (mg/L as $CaCO_3$)	Hardness (mg/L as $CaCO_3$)	Total Ammonia (ppm NH_3) [a]
Plow-SED-8	6.21	7.50	21.91	282	94.5	84	0.58
Plow-SED-9	6.94	7.85	21.85	295	106.5	96	0.72
Plow-SED-10	6.27	7.57	21.66	283	97.5	90	0.82
Plow-SED-11	5.32	7.44	22.03	295	101.5	98	0.85
Grove-SED-1	6.65	8.09	21.98	318	118	110	0.82
Grove-SED-2	6.57	7.82	21.91	304	107.5	100	0.77
Grove-SED-3	4.82	7.91	22.04	434	167	130	2.7
Control	5.90	7.88	21.97	325	120.5	110	0.40

[a] - Total Ammonia was performed on 2/25/05 due to lack of pillow packets
* - 1 microsiemen/cm (µS/cm) = 1 micromho/cm (µmho/cm)

Appendix D

Bench Sheets and Statistical Test Print-outs

Organism H. azteca
Study Fort Devens Sediment Toxicity Test
Test Date

Pan Number	Station	Number Alive	Number Dead	% Survival	Comments	Initials
1	Plow-SED-7-1	10				AF
2	Plow-SED-1-6	9				MMG
3	Plow-SED-5-3	10				AF
4	Plow-SED-6-6	9				AF
5	Plow-SED-4-4	~~10~~ 7				MMG
6	Plow-SED-5-6	10				AF
7	Control-1	10				MMG
8	Flan-SED-1-3	10				AF
9	Plow-SED-1-8	10				
10	Plow-SED-4-8	9				AF
11	Plow-SED-7-8	10				JBH
12	Plow-SED-3-5	9				AF
13	Plow-SED-1-5	8				AF
14	Plow-SED-6-1	9				MMG
15	Plow-SED-2-6	Spilled 2				AF
16	Plow-SED-6-3	7				JBH
17	Plow-SED-4-3	7				RAR
18	Plow-SED-2-7	9				AF
19	Plow-SED-1-3	10				JBH
20	Plow-SED-4-5	10				MMG
21	Plow-SED-5-7	9				AF
22	Plow-SED-3-2	10				JBH
23	Plow-SED-1-2	10				JBH
24	Flan-SED-1-4	10				RAR
25	Plow-SED-6-7	9				MMG
26	Plow-SED-2-4	8				AF
27	Plow-SED-6-4	10				JBH
28	Plow-SED-2-2	8				JBH
29	Plow-SED-3-1	10				RAR
30	Plow-SED-4-1	7				AF
31	Control-5	10				JBH
32	Plow-SED-1-4	9				RAR
33	Plow-SED-3-8	9				MMG/JBH
34	Plow-SED-2-1	10				JBH
35	Plow-SED-3-3	10				JBH
36	Plow-SED-5-8	8				JB

Organism H. azteca
Study Fort Devens Sediment Toxicity Test
Test Date

Pan Number	Station	Number Alive	Number Dead	% Survival	Comments	Initials
37	Control-3	10				TW
38	Plow-SED-2-8	8				JBH
39	Control-8	10				MMG
40	Flan-SED-1-8	9				JBH
41	Plow-SED-7-3	10				AF
42	Plow-SED-4-7	9				PAC
43	Plow-SED-2-3	10				SP
44	Plow-SED-3-6	9				TW
45	Plow-SED-6-5	9				TW
46	Plow-SED-5-4	10				MMG
47	Plow-SED-7-2	10				TW
48	Plow-SED-6-2	9	1			MMD
49	Plow-SED-3-7	10				MMG
50	Plow-SED-5-1	10				AF
51	Plow-SED-3-4	10				AF
52	Plow-SED-4-6	6				SP
53	Plow-SED-7-5	9				PAR
54	Flan-SED-1-6	10				JBH
55	Flan-SED-1-1	9				MMD
56	Plow-SED-2-5	10				AF
57	Plow-SED-5-2	10				MMG
58	Plow-SED-1-7	7				TW
59	Control-6	10				JBH
60	Plow-SED-4-2	~~8~~ 8				TW
61	Plow-SED-5-5	9				PAR
62	Flan-SED-1-2	9				MMD
63	Control-4	10				JBH
64	Plow-SED-7-6	9				MMG
65	Flan-SED-1-5	9				SP
66	Plow-SED-1-1	9				MMD
67	Plow-SED-7-4	10				PAR
68	Flan-SED-1-7	10				AF
69	Control-7	10				JBH
70	Plow-SED-7-7	9				PAR
71	Plow-SED-6-8	10				MMG
72	Control-2	10				JBH

Second Round - H. azteca

Organism H. azteca
Study Fort Devens Sediment Toxicity Test
Test Date

Pan Number	Station	Number Alive	Number Dead	% Survival	Comments	Initials
1	Grove-SED-1-8	10	0	100		SP
2	Plow-SED-10-3	9	1	90	1 CT pupae in sample	MMD
3	Plow-SED-11-1	6	0			JBH
4	Grove-SED-2-7	9				AF
5	Plow-SED-11-5	10	0	100		SP
6	Plow-SED-9-4	6				MMG
7	Grove-SED-2-3	10	0	100		SP
8	Plow-SED-8-7	9	1	90		MMD
9	Plow-SED-10-1	10	0			SBH
10	Plow-SED-8-4	9	1	90%		RAR
11	Control-1	10				AF
12	Plow-SED-10-7	9	0			SBH
13	Grove-SED-3-3	8	2	80	1 planaria, CT larvae	MMD
14	Grove-SED-1-1	7				MMG
15	Plow-SED-11-7	10				AF
16	Grove-SED-1-6	10	0	100		SP
17	Plow-SED-8-8	9	1	90%		RAR
18	Grove-SED-1-3	9	1	90%	1 CT larvae 1 CT pupae	MMD
19	Control-4	10				AF
20	Control-8	9	0			SBH
21	Plow-SED-9-8	1	9	10%	Strong fuel smell; sheen	SP
22	Grove-SED-1-2	11				MMG
23	Plow-SED-9-5	8	2	80%		RAR
24	Plow-SED-8-3	9				AF
25	Plow-SED-9-1	5	0			SBH
26	Plow-SED-11-4	9	1	90%		MMD
27	Grove-SED-2-1	10				SBH
28	Plow-SED-8-6	9	1	90%	1 planaria 1 scud 1 Hyalella blew out	MMD
29	Plow-SED-11-6	10				AF
30	Plow-SED-8-2	10				SBH
31	Control-6	10	0	100		SP
32	Grove-SED-3-6	10				AF
33	Grove-SED-1-7	10	0	100		SP
34	Plow-SED-9-2	5	5	50%	Strong fuel smell; sheen	SP
35	Grove-SED-2-4	9	1	90%		RAR
36	Grove-SED-3-2	6	4	60%	2 CTs found	MMD

Organism H. azteca
Study Fort Devens Sediment Toxicity Test
Test Date

Pan Number	Station	Number Alive	Number Dead	% Survival	Comments	Initials
37	Grove-SED-3-4	10	0			JBH
38	Grove-SED-2-2	10				JBH
39	Plow-SED-10-6	10	0			RAR
40	Plow-SED-11-3	9	1	90%		SP
41	Control-3	10	0	100%		MMG
42	Grove-SED-3-5	10	0	100		RAR
43	Grove-SED-2-6	10				MF
44	Grove-SED-3-8	10	0			JBH
45	Control-2	10	0			JBH
46	Grove-SED-1-4	9	1			MMG
47	Plow-SED-11-2	10	0	100%		SP
48	Plow-SED-9-7	5				JBH
49	Grove-SED-2-8	10				MF
50	Grove-SED-2-5	10	0	100		RAR
51	Control-5	10				MMG
52	Grove-SED-3-7	7	3	70%		MMG
53	Plow-SED-9-3	6	4	60%		RAR
54	Plow-SED-10-4	10	0	100		SP
55	Grove-SED-1-5	9				MF
56	Plow-SED-8-5	9				MMG
57	Grove-SED-3-1	0		0%	five damselfly nymph found in the sediment	SP
58	Plow-SED-10-2	9	1	90%		RAR
59	Control-7	10				MMG
60	Plow-SED-9-6	4	6	40%	Strong fuel smell; sheen	SP
61	Plow-SED-11-8	7	3	70%		MMG
62	Plow-SED-10-8	10	0	100%		MF
63	Plow-SED-10-5	10	0			JBH
64	Plow-SED-8-1	9				MMG

Organism C. tentans
Study Fort Devens Sediment Toxicity Test
Test Date

Pan Number	Station	Number Alive	Number Dead	% Survival	Comments	Initials
1	Plow-SED-7-1	9	1	90		SP
2	Plow-SED-1-6	10	0	100		RAR
3	Plow-SED-5-3	9	1	90		SP
4	Plow-SED-6-6	8	2	80		RAR
5	Plow-SED-4-4	10	0	100		SP
6	Plow-SED-5-6	10	0	100		RAR
7	Control-1	8	2	80		SP
8	Flan-SED-1-3	10	0	100		RAR
9	Plow-SED-1-8	10	0	100		SP
10	Plow-SED-4-8	10	0	100		MMD
11	Plow-SED-7-8	10	0	100		SP
12	Plow-SED-3-5	10	0	100		MMD
13	Plow-SED-1-5	10	0	100		MMD
14	Plow-SED-6-1	10	0	100		SP
15	Plow-SED-2-6	10	0	100		RAR
16	Plow-SED-6-3	10	0	100		MMD
17	Plow-SED-4-3	9	1	90		SP
18	Plow-SED-2-7	10	0	100		RAR
19	Plow-SED-1-3	10	0	100		SP
20	Plow-SED-4-5	10	0	100		MMD
21	Plow-SED-5-7	8	2	80		SP
22	Plow-SED-3-2	10	0	100		MMD
23	Plow-SED-1-2	10	0	100		SP
24	Flan-SED-1-4	10	0	100		MMD
25	Plow-SED-6-7	10	0	100		SP
26	Plow-SED-2-4	10	0	100 %		MMD
27	Plow-SED-6-4	10	0	100		SP
28	Plow-SED-2-2	11	0	110%		MMD
29	Plow-SED-3-1	8	2	80		SP
30	Plow-SED-4-1	10	0	100		MMD
31	Control-5	9	1	90		SP
32	Plow-SED-1-4	11	0	110%		MMD
33	Plow-SED-3-8	10	0	100		SP
34	Plow-SED-2-1	10	0	100		MMD
35	Plow-SED-3-3	10	0	100		SP
36	Plow-SED-5-8	10	0	100		MMD

Organism C. tentans
Study Fort Devens Sediment Toxicity Test
Test Date

Pan Number	Station	Number Alive	Number Dead	% Survival	Comments	Initials
37	Control-3	10	0	100%		MMD
38	Plow-SED-2-8	10	0	100		SP
39	Control-8	10	0	100		MMD
40	Flan-SED-1-8	10	0	100		SP
41	Plow-SED-7-3	11	0	100		[illegible]
42	Plow-SED-4-7	10	0	100		SP
43	Plow-SED-2-3	10	0	100		RAR
44	Plow-SED-3-6	10	0	100		SP
45	Plow-SED-6-5	10	0	100%		[illegible]
46	Plow-SED-5-4	9	1	90		RAR
47	Plow-SED-7-2	10	0	100		SP
48	Plow-SED-6-2	10	0	100		RAR
49	Plow-SED-3-7	10	0	100		[illegible]
50	Plow-SED-5-1	9	1	90		SP
51	Plow-SED-3-4	10	0	100		RAR
52	Plow-SED-4-6	10	0	100		RAR
53	Plow-SED-7-5	10	0	100		[illegible]
54	Flan-SED-1-6	10	0	100		MMD
55	Flan-SED-1-1	10	0	100		[illegible]
56	Plow-SED-2-5	10	0	100		RAR
57	Plow-SED-5-2	10	0	100		[illegible]
58	Plow-SED-1-7	10	0	100		MMD
59	Control-6	9	1	90		RAR
60	Plow-SED-4-2	10	0	100		[illegible]
61	Plow-SED-5-5	10	0	100		MMD
62	Flan-SED-1-2	10	0	100		SP
63	Control-4	9	1	90		[illegible]
64	Plow-SED-7-6	10	0	100		SP
65	Flan-SED-1-5	10	0	100		SP
66	Plow-SED-1-1	9	1	90		MMD
67	Plow-SED-7-4	10	0	100		SP
68	Flan-SED-1-7	10	0	100		MMD
69	Control-7	9	1	90		SP
70	Plow-SED-7-7	9	1	90		MMD
71	Plow-SED-6-8	10	0	100		SP
72	Control-2	10	0	100	1 Small 9 Large	MMD

Organism C. tentans
Study Fort Devens Sediment Toxicity Test
Test Date

Pan Number	Station	Number Alive	Number Dead	% Survival	Comments	Initials
1	Grove-SED-1-8	9				MF
2	Plow-SED-10-3	10				MF
3	Plow-SED-11-1	10				MF
4	Grove-SED-2-7	10				MMG
5	Plow-SED-11-5	10				MF
6	Plow-SED-9-4	2				MMD
7	Grove-SED-2-3	10				MMG
8	Plow-SED-8-7	9				MF
9	Plow-SED-10-1	10				MMG
10	Plow-SED-8-4	10				MMD
11	Control-1	8				MF
12	Plow-SED-10-7	9				MMG
13	Grove-SED-3-3	8				MMD
14	Grove-SED-1-1	8				MF
15	Plow-SED-11-7	10				MF
16	Grove-SED-1-6	10				MMG
17	Plow-SED-8-8	9				MF
18	Grove-SED-1-3	9				MMD
19	Control-4	9			one floating - dead	MMG
20	Control-8	9				MF
21	Plow-SED-9-8	3				MMG
22	Grove-SED-1-2	10				MF
23	Plow-SED-9-5	3				PAR
24	Plow-SED-8-3	9				MF
25	Plow-SED-9-1	3				MMD
26	Plow-SED-11-4	9				PAR
27	Grove-SED-2-1	10				MF
28	Plow-SED-8-6	8				MF
29	Plow-SED-11-6	9				MMD
30	Plow-SED-8-2	10				MF
31	Control-6	7				MMD
32	Grove-SED-3-6	10				MMD
33	Grove-SED-1-7	9				MF
34	Plow-SED-9-2	4				MF
35	Grove-SED-2-4	10				MMD
36	Grove-SED-3-2	9				MMG

Organism C. tentans
Study Fort Devens Sediment Toxicity Test
Test Date

Pan Number	Station	Number Alive	Number Dead	% Survival	Comments	Initials
37	Grove-SED-3-4	10				MMG
38	Grove-SED-2-2	10				MMD
39	Plow-SED-10-6	12				AF
40	Plow-SED-11-3	8				MMG
41	Control-3	9				MMD
42	Grove-SED-3-5	10				AF
43	Grove-SED-2-6	20			Double-Inoculated	MMD
44	Grove-SED-3-8	10				AF
45	Control-2	10				JBH
46	Grove-SED-1-4	9				MMG
47	Plow-SED-11-2	8				MMD
48	Plow-SED-9-7	7				AF
49	Grove-SED-2-8	10				JBH
50	Grove-SED-2-5	9				MMG
51	Control-5	7			sieved	MMG
52	Grove-SED-3-7	~~10~~ 12 MD				MMD
53	Plow-SED-9-3	6				MMD
54	Plow-SED-10-4	8				MMG
55	Grove-SED-1-5	10				MMD
56	Plow-SED-8-5	8				AF
57	Grove-SED-3-1	10				MMD
58	Plow-SED-10-2	9+1 pupa				MMG
59	Control-7	9				MMG
60	Plow-SED-9-6	8				MMD
61	Plow-SED-11-8	8				MMG
62	Plow-SED-10-8	10				MMD
63	Plow-SED-10-5	10				MMD
64	Plow-SED-8-1	10				MMG/MMD

Devens sed Tox Test H. azteca

Pan # (Randomization #)	Station #	Rep	Dry Pan Ash Tare weight	# of organisms	Dry weight	~~Ash Free Weight~~	avg dry weight	avg Ash-Free weight
1	Plow 7	1	1.23760	10	1.23850	10 ⇒	org # off	
2	Plow 1	6	1.22167	9	1.22268	9	Data sheets	
3	Plow 5	3	1.24566	10	1.24685	10		
4	Plow 6	6	1.24088	9	1.24185	9		
5	Plow 4	4	1.23029	8	1.23105	7		
6	Plow 5	6	1.22344	9	1.22418	10		
7	Control	1	1.22095	10	1.22180	10		
8	Flan 1	3	1.23014	10	1.23131	10		
9	Plow 1	8	1.23732	10	1.23852	10		
10	Plow 4	8	1.21703	9	1.21751	9		
11	Plow 7	8	1.23285	9	1.23397	10		
12	Plow 3	5	1.24056	9	1.24114	9		
13	Plow 1	5	1.23728	8	1.23780	8		
14	Plow 6	1	1.22256	9	1.22354	9		
15	Plow 2	6	1.21982	2	1.221997	2		
16	Plow 6	3	1.21947	7	1.21994	7		
17	Plow 4	3	1.23251	7	1.23301	7		
18	Plow 2	7	1.22341	9	1.22409	9		
19	Plow 1	3	1.24837	10	1.24896	10		
20	Plow 4	5	1.22917	10	1.22991	10		
21	Plow 5	7	1.23789	9	1.23886	9		
22	Plow 3	2	1.23849	9	1.23927	10		
23	Plow 1	2	1.24229	10	1.24317	10		
24	Flan 1	4	1.24169	10	1.24259	10		
25	Plow 6	7	1.24515	9	1.24603	9		
26	Plow 2	4	1.23482	8	1.23550	8		
27	Plow 6	4	1.21534	10	1.21633	10		

Peven's 35D Tox Test H. azteca (Cont.)

Pan # (randomization #)	Station #	Rep	Dry Pan Tare weight	# of organisms	Dry weight	Ash Free weight	org dry weight	org Ash Free weight
28	Plow 2	2	1.23273	8	1.23336	8 ⇒	org. # off Data Sheet	
29	Plow 3	1	1.24070	10	1.24159	10		
30	Plow 4	1	1.21418	7	1.21487	7		
31	Control	5	1.22328	10	1.22420	10		
32	Plow 1	4	1.21930	9	1.21962	9		
33	Plow 3	8	1.23596	9	1.23660	9		
34	Plow 2	1	1.22426	10	1.22501	10		
35	Plow 3	3	1.21467	10	1.21537	10		
36	Plow 5	8	1.22453	8	1.22549	8		
37	Control	3	1.20998	10	1.21096	10		
38	Plow 2	8	1.23879	8	1.23942	8		
39	Control	8	1.21585	10	1.21653	10		
40	Flan 1	8	1.21643	9	1.21726	9		
41	Plow 7	3	1.21778	10	1.21872	10		
42	Plow 4	7	1.20289	9	1.20354	9		
43	Plow 2	3	1.23132	10	1.23215	10		
44	Plow 3	6	1.22366	9	1.22430	9		
45	Plow 6	5	1.23247	9	1.23336	9		
46	Plow 5	4	1.22600	10	1.22708	10		
47	Plow 7	2	1.21417	10	1.21520	10		
48	Plow 6	2	1.22238	9	1.22354	9		
49	Plow 3	7	1.22792	10	1.22887	10		
50	Plow 5	1	1.21277	10	1.21393	10		
51	Plow 3	4	1.21530	10	1.21610	10		
52	Plow 4	6	1.24339	6	1.24408	6		
53	Plow 7	5	1.23578	9	1.23676	9		
54	Flan 1	6	1.24037	10	1.24116	10		

Devens Sed Tox Test H azteca (cont.)

Pan # (randomization #)	Station #	Rep	Dry Pan Ash Tare weight	# of organisms	Dry weight	~~Ash Free Weight~~	~~org dry weight~~	~~org Ash Free weight~~
55	Flan 1	1	1.21615	9	1.21763	9	org # off	
56	Plow 2	5	1.23575	10	1.23678	10	Data Sheet	
57	Plow 5	2	1.24462	RAR ~~7~~ 10	1.24549	10		
58	Plow 1	7	1.24022	7	1.24108	7		
59	Control	6	1.22434	10	1.22518	10		
60	Plow 4	2	1.22806	8	1.22884	8		
61	Plow 5	5	1.21711 RAR	9	1.21796	9		
62	Flan 1	2	1.22318	9	1.23146	9		
63	Control	4	1.23046	9 10	1.22452	10		
64	Plow 7	6	1.21848	9	1.21948	9		
65	Flan 1	5	1.23018	9	1.23151	9		
66	Plow 1	1	1.22677	9	1.22781	9		
67	Plow 7	4	1.22535	10	1.22669	10		
68	Flan 1	7	1.23628	10	1.23764	10		
69	Control	7	1.22895	10	1.23041	10		
70	Plow 7	7	1.21380	9	1.21449	9		
71	Plow 6	8	1.22010	10	1.22094	10		
72	Control	2	1.22808	10	1.22920	10		

RAR 2/14/05 - Tare weight

RAR 2/22/05 = Dry weight

Devens Sed Tox Test C. Tentans

Pan # (randomization #)	Station#	Rep	Pan-Ash Tare weight	# of organisms	Dry weight	Ash-Free weight	avg dry weight	avg ash-free weight
1	Plow 7	7	1.22440	9	1.23618	1.22678		
2	Plow 1	6	1.22686	10	1.24013	1.22917		
3	Plow 5	3	1.23324	9	1.24705	1.23606		
4	Plow 6	6	1.22756	8	1.23993	1.23000		
5	Plow 4	4	1.22779	10	1.24589	1.23239		
6	Plow 5	6	1.20949	10	1.22291	1.21172		
7	Control	1	1.21889	8	1.23354	1.22217		
8	Flan 1	3	1.22080	10	1.23313	1.22268		
9	Plow 1	8	1.23012	10	1.24309	1.23260		
10	Plow 4	8	1.23793	10	1.25603	1.24259		
11	Plow 7	8	1.23860	10	1.25256	1.24151		
12	Plow 3	5	1.22721	10	1.24472	1.23518		
13	Plow 1	5	1.22279	10	1.23588	1.22541		
14	Plow 6	1	1.22884	10	1.24363	1.23156		
15	Plow 2	6	1.20325	10	1.21528	1.20529		
16	Plow 6	3	1.22945	10	1.24666	1.23305		
17	Plow 4	3	1.24753	9	1.26370	1.25157		
18	Plow 2	7	1.23636	10	1.25042	1.23894		
19	Plow 1	3	1.23883	10	1.25417	1.24196		
20	Plow 4	5	1.22093	10	1.23620	1.22427		
21	Plow 5	7	1.21033	8	1.22323	1.21300		
22	Plow 3	2	1.22212	10	1.23708	1.22806		
23	Plow 1	2	1.20219	10	1.21649	1.20491		
24	Flan 1	4	1.24733	10	1.25827	1.24943		
25	Plow 6	7	1.21093	10	1.22729	1.21445		
26	Plow 2	4	1.22064	10	1.23350	1.22293		
27	Plow 6	4	1.23330	10	1.24972	1.23658		

Devens Sed Toxi Test C. Tentans (cont.)

Pan # (Randomization #)	Station #	Rep.	Pan Ash Tare Weight	# of organisms	Dry Weight	Ash Free Weight	org. dry weight	org. Ash Free Weight
28	Plow 2	2	1.24083	11	1.25490	1.24323		
29	Plow 3	1	1.22856	8	1.24437	1.23388		
30	Plow 4	1	1.23196	10	1.24907	1.23576		
31	Control	5	1.21472	9	1.23152	1.21893		
32	Plow 1	4	1.21367	11	1.22714	1.21575		
33	Plow 3	8	1.20663	10	1.22490	1.21438		
34	Plow 2	1	1.212766	10	1.22453	1.21474		
35	Plow 3	3	1.20038	10	1.21834	1.20785		
36	Plow 5	8	1.21450	10	1.22868	1.21706		
37	Control	3	1.22545	10	1.24380	1.23049		
38	Plow 2	8	1.22302	10	1.23661	1.22594		
39	Control	8	1.21835	10	1.23836	1.22420		
40	Flan 1	8	1.21971	10	1.23343	1.22213		
41	Plow 7	3	1.20815	11	1.22526	1.21166		
42	Plow 4	7	1.20022	10	1.21743	1.20425		
43	Plow 2	3	1.21631	10	1.22760	1.21791		
44	Plow 3	6	1.22264	10	1.24312	1.23080		
45	Plow 6	5	1.22540	10	1.23861	1.22806		
46	Plow 5	4	1.20232	9	1.21532	1.20445		
47	Plow 7	2	1.20679	10	1.22142	1.20962		
48	Plow 6	2	1.20747	10	1.22058	1.20994		
49	Plow 3	7	1.21433	10	1.23223	1.22167		
50	Plow 5	1	1.19929	9	1.21375	1.20190		
51	Plow 3	4	1.20603	10	1.22655	1.21443		
52	Plow 4	6	1.20183	10	1.22004	1.20604		
53	Plow 7	5	1.20380	10	1.21775	1.20665		
54	Flan 1	6	1.20618	10	1.21567	1.20781		

Davens Sed Toxi Test C. Tentans (cont.)

Pan # randomization #	Station #	Rep	Pan Ash Tare weight	# of organisms	Dry weight	Ash Free weight	org dry weight	org Ash-Free weight
55	Flan 1	1	1.21303	10	1.22418	1.21525		
56	Plow 2	5	1.20978	10	1.21981	1.21179		
57	Plow 5	2	1.20145	10	1.21583	1.20396		
58	Plow 1	7	1.22345	10	1.23620	1.22585		
59	Control	6	1.20627	9	1.22147	1.21034		
60	Plow 4	2	1.21372	10	1.22008	1.21784		
61	Plow 5	5	1.20644	10	1.22055	1.20898		
62	Flan 1	2	1.20617	10	1.21805	wrong pan # ~~1.23470~~	1.20848	
63	Control	4	1.21703	9	1.23513	1.22265		
64	Plow 7	6	1.21861	10	1.23375	1.22160		
65	Flan 1	5	1.21307	10	1.22438	1.21523		
66	Plow 1	1	1.20735	9	1.22057	1.20984		
67	Plow 7	4	1.23179	10	1.24770	1.23470		
68	Flan ~~Plow 1~~ RAR	7	1.21981	10	1.23191	1.22203		
69	Control	7	1.22400	9	1.24052	1.22785		
70	Plow 7	7	1.21507	9	1.23071	1.21850		
71	Plow 6	8	1.20352	10	1.22127	1.20739		
72	control	2	1.20335	10	1.21803	1.20670		

RAR 2/16/05 - Tare weight
RAR 2/23/05 - Dry weight
RAR 2/24/05 -- Ash weight

RAR 2/28/05 - Dry weights/Ash weights

Devers 800 Tox Test H. azteca

Pan# randomization#	Station #	Rep	Dry Tare Weight	# of organ.	Dry weight	organism weight
1	Grove 1	8	1.21515	10	1.21614	
2	Plow 10	3	1.20177	9	1.20246	
3	Plow 11	1	1.21141	6	1.21182	
4	Grove 2	7	1.21777	8	1.21847	
5	Plow 11	5	1.23000	10	1.23084	
6	Plow 9	4	1.21899	6	1.21938	
7	Grove 2	3	1.20761	10	1.20869	
8	Plow 8	7	1.20334	10	1.20451	
9	Plow 10	1	1.21579	10	1.21676	
10	Plow 8	4	1.21229	9	1.21387	
11	Control	1	1.20842	10	1.20432	
12	Plow 10	7	1.21236	9	1.21350	
13	Grove 3	3	1.20332	8	1.20401	
14	Grove 1	1	1.21093	7	1.21138	
15	Plow 11	7	1.21745	10	1.21855	
16	Grove 1	6	1.20406	10	1.20579	
17	Plow 8	8	1.21520	9	1.21607	
18	Grove 1	3	1.22408	9	1.22490	
19	Control	4	1.20637	10	1.20753	
20	Control	8	1.20465	9	1.20526	
21	Plow 9	8	1.20134	1	1.20143	
22	Grove 1	2	1.21239	11	1.21324	
23	Plow 9	5	1.21101	8	1.21174	
24	Plow 8	3	1.22218	9	1.22301	
25	Plow 9	1	1.22359	4	1.22387	
26	Plow 11	4	1.21955	9	1.22040	
27	Grove 2	1	1.22651	10	1.22780	

Devens Sed Tox Test H. zea (cont)

Pan # (randomization #)	Station #	Rep	Dry Tare weight	# of organisms	Dry weight	organism weight
28	Plow 8	6	1.20558	8	1.20648	
29	Plow 11	6	1.20389	10	1.20484	
30	Plow 8	2	1.21371	10	1.21464	
31	Control	6	1.22310	10	1.22396	
32	Grove 3	6	1.22681	10	1.22763	
33	Grove 1	7	1.20710	10	1.20792	
34	Plow 9	2	1.23276	5	1.23299	
35	Grove 2	4	1.20429	9	1.20536	
36	Grove 3	2	1.19920	10	1.19984	
37	Grove 3	4	1.19991	10	1.20070	
38	Grove 2	2	1.20610	10	1.20703	
39	Plow 10	6	1.21689	10	1.21811	
40	Plow 11	3	1.20449	9	1.20511	
41	Control	3	1.20804	10	1.20868	
42	Grove 3	5	1.21375	10	1.21440	
43	Grove 2	6	1.19741	10	1.19851	
44	Grove 3	8	1.21540	10	1.21622	
45	Control	2	1.21177	10	1.21254	
46	Grove 1	4	1.21117	9	1.21205	
47	Plow 11	2	1.20355	10	1.20438	
48	Plow 9	7	1.20534	5	1.20556	
49	Grove 2	8	1.20673	10	1.20767	
50	Grove 2	5	1.21379	10	1.21483	
51	Control	5	1.20881	10	1.20960	
52	Grove 3	7	1.20342	7	1.20391	
53	Plow 9	3	1.20501	6	1.20541	
54	Plow 10	4	1.21486	9	1.21562	

Devens SED Tox Test H. azteca (cont.)

Pan # randomization #	Station #	Rep	Dry Tare Weight	# of organisms	Dry weight	organism weight
55	Grove 1	5	1.22499	9	1.22573	
56	Plow 8	5	1.21075	9	1.21170	
57	Grove 3	1	1.23472	0	—	
58	Plow 10	2	1.19948	9	1.20030	
59	Control	7	1.20384	10	1.20445	
60	Plow 9	6	1.21544	4	1.21571	
61	Plow 11	8	1.22852	7	1.22914	
62	Plow 10	8	1.21920	10	1.22009	
63	Plow 10	5	1.22343	10	1.22430	
64	Plow 8	1	1.21321	9	1.21407	

RAR 2/~~[illegible]~~ 24 /05 - Tare Weight RAR

RAR 3/1/05 - Dry Weight

Devens Sed Tox Test C. Tentans

Pan # (randomization #)	Station #	Rep	Pan Ash Weight	# of organisms	Dry Weight	Ash Free Weight	org. dry Weight	org. Ash-Free Weight
1	Grove 1	8	1.20825	9	1.22382	1.21248		
2	Plow 10	3	1.21311	10	1.22533	1.21568		
3	Plow 11	1	1.20366	10	1.21773	1.20971		
4	Grove 2	7	1.20052	10	1.21193	1.20320		
5	Plow 11	5	1.20045	10	1.21580	1.20392		
6	Plow 9	4	1.22325	2	1.22360	1.22340		
7	Grove 2	3	1.21254	10	1.22393	1.21506		
8	Plow 8	7	1.20513	9	1.21594	1.20696		
9	Plow 10	1	1.20670	10	1.21695	1.20881		
10	Plow 8	4	1.21108	10	1.22002	1.21302		
11	Control	1	1.20203	8	1.21289	1.20446		
12	Plow 10	7	1.22612	9	1.23587	1.22805		
13	Grove 3	3	1.20215	8	1.21076	1.20353		
14	Grove 1	1	1.22468	8	1.23712	1.22939		
15	Plow 11	7	1.21801	10	1.23052	1.22061		
16	Grove 1	6	1.22081	10	1.23339	1.22532		
17	Plow 8	8	1.20450	9	1.21539	1.20697		
18	Grove 1	3	1.20520	9	1.21784	1.20969		
19	Control	4	1.22379	9	1.23559	1.22656		
20	Control	8	1.20478	9	1.21518	1.20662		
21	Plow 9	8	1.22442	3	1.22528	1.22455		
22	Grove 1	2	1.22309	10	1.23516	1.22735		
23	Plow 9	5	1.21808	3	1.21855	1.21821		
24	Plow 8	3	1.21563	9	1.22707	1.21850		
25	Plow 9	1	1.21947	3	1.22026	1.21982		
26	Plow 11	4	1.21719	9	1.23104	1.22035		
27	Grove 2	1	1.20928	10	1.21965	1.21186		

Devens SED Tox Test C. Tentans (cont.)

Pan # (randomized order)	Station #	Rep	Pan ash weight	# of organisms	Dry weight	Ash Free weight	org dry weight	org Ash Free weight
28	Plow 8	6	1.20360	8	1.21376	1.20563		
29	Plow 11	6	1.20748	9	1.21980	1.21017		
30	Plow 8	2	1.22537	10	1.23577	1.22761		
31	Control	6	1.20712	7	1.22044	1.21122		
32	Grove 3	6	1.20687	10	1.21900	1.20912		
33	Grove 1	7	1.21709	9	1.22987	1.22126		
34	Plow 9	2	1.22279	4	1.22409	1.22338		
35	Grove 2	4	1.20512	10	1.21529	1.20714		
36	Grove 3	2	1.21607	9	1.22636	1.21824		
37	Grove 3	4	1.20683	10	1.21972	1.20931		
38	Grove 2	2	1.20371	10	1.21452	1.20614		
39	Plow 10	6	1.21362	12	1.22999	1.21672		
40	Plow 11	3	1.22358	8	1.23414	1.22565		
41	Control	3	1.21941	9	1.23176	1.22207		
42	Grove 3	5	1.22362	10	1.23435	1.22580		
43	Grove 2	6	1.20400	20	1.22030	1.20786		
44	Grove 3	8	1.21597	10	1.22725	1.21888		
45	Control	2	1.21911	10	1.23494	1.22302		
46	Grove 1	4	1.22072	9	1.23595	1.22546		
47	Plow 11	2	1.20374	~~8~~	~~1.21785~~ 1.21630	1.20617		
48	Plow 9	7	1.21581	ok 7 ~~10~~	~~1.21785~~ ok	1.21640		
49	Grove 2	8	1.20499	9	1.22938	1.20749		
50	Grove 2	5	1.21780	~~9~~ 10	1.21499	1.22021		
51	Control	5	1.20683	7	1.21663	1.20858		
52	Grove 3	7	1.20854	12	1.22098	1.21138		
53	Plow 9	3	1.22526	6	1.22407	1.22554		
54	Plow 10	4	1.21034	8	1.22212	1.21246		

Dewens SED Tox Test

C. Tentans (cont.)

Pan# (randomization #1)	Station #	Rep	Pan Ash Tare weight	# of Organisms	Dry Weight	Ash Free Weight	org dry weight	org Ash Free weight
55	Grove 1	5	1.20512	10	1.22208	1.21051		
56	Plow 8	5	1.21781	8	1.22835	1.21993		
57	Grove 3	1	1.20733	10	1.21996	1.21000		
58	Plow 10	2	1.20951	9	1.22114	1.21159		
59	Control	7	1.21088	9	1.22348	1.21349		
60	Plow 9	6	1.20190	8	1.20378	1.20259		
61	Plow 11	8	1.20709	8	1.22145	1.20993		
62	Plow 10	8	1.20651	10	1.22094	1.20914		
63	Plow 10	5	1.21104	10	1.22543	1.21410		
64	Plow 8	7	1.20623	10	1.21801	1.20834		

RAR 2/23/05 - tare weights
RAR 3/1/05 - Dry weights/Ash weight
RAR 3/2/05 - Dry weight / Ash weight

CETIS Data Worksheet

Report Date: 22 Apr-05 3:10 PM
Link: 06-3816-4762/Round 1

Hyalella 10-d Survival and Growth Sediment Test — **U.S. EPA Region I Lab**

Start Date: 08 Feb-05	**Species:** Hyalella azteca	**Sample Code:** 0205HACSTLC1	
Ending Date:	**Protocol:** EPA/600/R-99/064 (2000)	**Sample Source:** Fort Devens LC SD 1	
Sample Date: 07 Feb-05	**Material:** LAB ARTIFICIAL SEDIMENT	**Sample Station:** LC1	

Sample Code	Rep	Pos	# Exposed	# Survived	Total Weight-mg	Tare Weight-mg	Pan Count	Mean Length-mm	Notes
0205HACSTLC1	1		10	10	1221.8	1220.95	10		
0205HACSTLC1	2		10	10	1229.2	1228.08	10		
0205HACSTLC1	3		10	10	1210.96	1209.98	10		
0205HACSTLC1	4		10	10	1224.52	1223.18	10		
0205HACSTLC1	5		10	10	1224.2	1223.28	10		
0205HACSTLC1	6		10	10	1225.18	1224.34	10		
0205HACSTLC1	7		10	10	1230.41	1228.95	10		
0205HACSTLC1	8		10	10	1216.53	1215.85	10		
0205HACSTF1	1		10	9	1217.63	1216.15	9		
0205HACSTF1	2		10	9	1231.46	1230.46	9		
0205HACSTF1	3		10	10	1231.31	1230.14	10		
0205HACSTF1	4		10	10	1242.59	1241.69	10		
0205HACSTF1	5		10	9	1231.51	1230.18	9		
0205HACSTF1	6		10	10	1241.16	1240.37	10		
0205HACSTF1	7		10	10	1237.64	1236.28	10		
0205HACSTF1	8		10	9	1217.26	1216.43	9		
0205HACSTPS1	1		10	9	1227.81	1226.77	9		
0205HACSTPS1	2		10	10	1243.17	1242.29	10		
0205HACSTPS1	3		10	10	1248.96	1248.37	10		
0205HACSTPS1	4		10	9	1219.62	1219.3	9		
0205HACSTPS1	5		10	8	1237.8	1237.28	8		
0205HACSTPS1	6		10	9	1222.68	1221.67	9		
0205HACSTPS1	7		10	7	1241.08	1240.22	7		
0205HACSTPS1	8		10	10	1238.52	1237.32	10		
0205HACSTPS2	1		10	10	1225.01	1224.26	10		
0205HACSTPS2	2		10	8	1233.36	1232.73	8		
0205HACSTPS2	3		10	10	1232.15	1231.32	10		
0205HACSTPS2	4		10	8	1235.5	1234.82	8		
0205HACSTPS2	5		10	10	1236.78	1235.75	10		
0205HACSTPS2	6		10	9	1224.09	1223.41	9		
0205HACSTPS2	7		10	8	1239.42	1238.79	8		
0205HACSTPS3	1		10	10	1241.59	1240.7	10		
0205HACSTPS3	2		10	9	1239.27	1238.49	9		
0205HACSTPS3	3		10	10	1215.37	1214.67	10		
0205HACSTPS3	4		10	10	1216.1	1215.3	10		
0205HACSTPS3	5		10	9	1241.14	1240.56	9		
0205HACSTPS3	6		10	9	1224.3	1223.66	9		
0205HACSTPS3	7		10	10	1228.87	1227.92	10		
0205HACSTPS3	8		10	9	1236.6	1235.96	9		
0205HACSTPS4	1		10	7	1214.87	1214.18	7		
0205HACSTPS4	2		10	8	1228.84	1228.06	8		
0205HACSTPS4	3		10	7	1233.01	1232.51	7		
0205HACSTPS4	4		10	8	1231.05	1230.29	8		
0205HACSTPS4	5		10	10	1229.91	1229.17	10		
0205HACSTPS4	6		10	6	1244	1243.39	6		
0205HACSTPS4	7		10	9	1203.54	1202.89	9		
0205HACSTPS4	8		10	9	1217.51	1217.03	9		
0205HACSTPS5	1		10	10	1213.93	1212.77	10		
0205HACSTPS5	2		10	10	1245.49	1244.62	10		
0205HACSTPS5	3		10	10	1246.85	1245.66	10		
0205HACSTPS5	4		10	10	1227.08	1226	10		
0205HACSTPS5	5		10	9	1217.96	1217.11	9		
0205HACSTPS5	6		10	9	1224.18	1223.44	9		

CETIS Data Worksheet

Report Date: 22 Apr-05 3:10 PM
Link: 06-3816-4762/Round 1

Sample Code	Rep	Pos	# Exposed	# Survived	Total Weight-mg	Tare Weight-mg	Pan Count	Mean Length-mm	Notes
0205HACSTPS5	7		10	9	1238.86	1237.89	9		
0205HACSTPS5	8		10	8	1225.49	1224.53	8		
0205HACSTPS6	1		10	9	1223.54	1222.56	9		
0205HACSTPS6	2		10	9	1223.54	1222.38	9		
0205HACSTPS6	3		10	7	1219.94	1219.47	7		
0205HACSTPS6	4		10	10	1216.33	1215.34	10		
0205HACSTPS6	5		10	9	1233.36	1232.47	9		
0205HACSTPS6	6		10	9	1241.65	1240.68	9		
0205HACSTPS6	7		10	9	1246.03	1245.15	9		
0205HACSTPS6	8		10	10	1220.94	1220.1	10		
0205HACSTPS7	1		10	10	1238.5	1237.6	10		
0205HACSTPS7	2		10	10	1215.2	1214.17	10		
0205HACSTPS7	3		10	10	1218.72	1217.78	10		
0205HACSTPS7	4		10	10	1226.69	1225.35	10		
0205HACSTPS7	5		10	9	1236.76	1235.78	9		
0205HACSTPS7	6		10	9	1219.48	1218.48	9		
0205HACSTPS7	7		10	9	1214.49	1213.8	9		
0205HACSTPS7	8		10	9	1233.97	1232.85	9		

Analyst:________ Reviewed By:________

CETIS Test Summary

Report Date: 22 Apr-05 2:40 PM
Link: 06-3816-4762/Round 1

Hyalella 10-d Survival and Growth Sediment Test — **U.S. EPA Region I Lab**

Test No:	13-2527-7965	**Test Type:**	Survival-Growth	**Duration:**	N/A
Start Date:	08 Feb-05	**Protocol:**	EPA/600/R-99/064 (2000)	**Species:**	Hyalella azteca
Ending Date:		**Dil Water:**	None	**Source:**	In-House Culture
Setup Date:	08 Feb-05	**Brine:**			

Comments: Fort Devens Sediment Toxicity Test Round 1

Sample No:	12-4569-5350	**Material:**	Reference sediment	**Client:**	EPA REGION 1
Sample Date:	02 Feb-05 02:10 PM	**Code:**	0205HACSTF1	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens Flannagan SD		
Sample Age:	5d 9h	**Station:**	F1		

Comments: Fort Devens Sediment Toxicity Test

Sample No:	10-5013-8838	**Material:**	LAB ARTIFICIAL SEDIMENT	**Client:**	EPA REGION 1
Sample Date:	07 Feb-05	**Code:**	0205HACSTLC1	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens LC SD 1		
Sample Age:	24h	**Station:**	LC1		

Comments: Fort Devens Sediment Toxicity Test Round 1

Sample No:	06-2559-6491	**Material:**	Site Sediment Sample	**Client:**	EPA REGION 1
Sample Date:	01 Feb-05 04:15 PM	**Code:**	0205HACSTPS1	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens Plow Shop SD		
Sample Age:	6d 7h	**Station:**	PS1		

Comments: Fort Devens Sediment Toxicity Test

Sample No:	15-1307-3691	**Material:**	Site Sediment Sample	**Client:**	EPA REGION 1
Sample Date:	01 Feb-05 03:15 PM	**Code:**	0205HACSTPS2	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens Plow Shop SD		
Sample Age:	6d 8h	**Station:**	PS2		

Comments: Fort Devens Sediment Toxicity Test

Sample No:	02-3051-5023	**Material:**	Site Sediment Sample	**Client:**	EPA REGION 1
Sample Date:	01 Feb-05 02:40 PM	**Code:**	0205HACSTPS3	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens Plow Shop SD		
Sample Age:	6d 9h	**Station:**	PS3		

Comments: Fort Devens Sediment Toxicity Test

Sample No:	07-6595-6937	**Material:**	Site Sediment Sample	**Client:**	EPA REGION 1
Sample Date:	01 Feb-05 02:15 PM	**Code:**	0205HACSTPS4	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens Plow Shop SD		
Sample Age:	6d 9h	**Station:**	PS4		

Comments: Fort Devens Sediment Toxicity Test

Sample No:	18-3003-6058	**Material:**	Site Sediment Sample	**Client:**	EPA REGION 1
Sample Date:	01 Feb-05 01:25 PM	**Code:**	0205HACSTPS5	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens Plow Shop SD		
Sample Age:	6d 10h	**Station:**	PS5		

Comments: Fort Devens Sediment Toxicity Test

Sample No:	11-4943-4728	**Material:**	Site Sediment Sample	**Client:**	EPA REGION 1
Sample Date:	01 Feb-05 01:15 PM	**Code:**	0205HACSTPS6	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens Plow Shop SD		
Sample Age:	6d 10h	**Station:**	PS6		

Comments: Fort Devens Sediment Toxicity Test

CETIS Test Summary

Report Date: 22 Apr-05 2:40 PM
Link: 06-3816-4762/Round 1

Sample No:	10-2222-3442	Material:	Site Sediment Sample	Client:	EPA REGION 1
Sample Date:	01 Feb-05 12:55 PM	Code:	0205HACSTPS7	Project:	Fort Devens Sediment Toxicity Test
Receive Date:		Source:	Fort Devens Plow Shop SD		
Sample Age:	6d 11h	Station:	PS7		

Comments: Fort Devens Sediment Toxicity Test

Mean Dry Biomass-mg Summary

Sample Code	Reps	Mean	Minimum	Maximum	SE	SD	CV
0205HACSTLC1	8	0.10238	0.06801	0.14601	0.00940	0.02657	25.96%
0205HACSTF1	8	0.11075	0.07900	0.14800	0.00934	0.02641	23.85%
0205HACSTPS1	8	0.08025	0.03199	0.12001	0.01056	0.02987	37.22%
0205HACSTPS2	7	0.07472	0.06300	0.10300	0.00542	0.01434	19.19%
0205HACSTPS3	8	0.07475	0.05800	0.09500	0.00460	0.01301	17.41%
0205HACSTPS4	8	0.06512	0.04800	0.07799	0.00405	0.01144	17.57%
0205HACSTPS5	8	0.09775	0.07401	0.11899	0.00557	0.01574	16.11%
0205HACSTPS6	8	0.08975	0.04700	0.11600	0.00702	0.01986	22.12%
0205HACSTPS7	8	0.10000	0.06899	0.13400	0.00656	0.01856	18.56%

Proportion Survived Summary

Sample Code	Reps	Mean	Minimum	Maximum	SE	SD	CV
0205HACSTLC1	8	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
0205HACSTF1	8	0.95000	0.90000	1.00000	0.01890	0.05345	5.63%
0205HACSTPS1	8	0.90000	0.70000	1.00000	0.03780	0.10690	11.88%
0205HACSTPS2	7	0.90000	0.80000	1.00000	0.03780	0.10000	11.11%
0205HACSTPS3	8	0.95000	0.90000	1.00000	0.01890	0.05345	5.63%
0205HACSTPS4	8	0.80000	0.60000	1.00000	0.04629	0.13093	16.37%
0205HACSTPS5	8	0.93750	0.80000	1.00000	0.02631	0.07440	7.94%
0205HACSTPS6	8	0.90000	0.70000	1.00000	0.03273	0.09258	10.29%
0205HACSTPS7	8	0.95000	0.90000	1.00000	0.01890	0.05345	5.63%

Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0205HACSTLC1	0.08501	0.11200	0.09800	0.13400	0.09199	0.08401	0.14601	0.06801
0205HACSTF1	0.14800	0.10000	0.11700	0.09000	0.13300	0.07900	0.13600	0.08300
0205HACSTPS1	0.10400	0.08800	0.05900	0.03199	0.05200	0.10100	0.08600	0.12001
0205HACSTPS2	0.07500	0.06300	0.08301	0.06801	0.10300	0.06799	0.06300	
0205HACSTPS3	0.08900	0.07800	0.07000	0.07999	0.05800	0.06400	0.09500	0.06400
0205HACSTPS4	0.06899	0.07799	0.05000	0.07600	0.07400	0.06100	0.06500	0.04800
0205HACSTPS5	0.11600	0.08700	0.11899	0.10800	0.08500	0.07401	0.09700	0.09600
0205HACSTPS6	0.09800	0.11600	0.04700	0.09900	0.08900	0.09700	0.08800	0.08400
0205HACSTPS7	0.09000	0.10299	0.09399	0.13400	0.09800	0.10000	0.06899	0.11200

Proportion Survived Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0205HACSTLC1	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
0205HACSTF1	0.90000	0.90000	1.00000	1.00000	0.90000	1.00000	1.00000	0.90000
0205HACSTPS1	0.90000	1.00000	1.00000	0.90000	0.80000	0.90000	0.70000	1.00000
0205HACSTPS2	1.00000	0.80000	1.00000	0.80000	1.00000	0.90000	0.80000	
0205HACSTPS3	1.00000	0.90000	1.00000	1.00000	0.90000	0.90000	1.00000	0.90000
0205HACSTPS4	0.70000	0.80000	0.70000	0.80000	1.00000	0.60000	0.90000	0.90000
0205HACSTPS5	1.00000	1.00000	1.00000	1.00000	0.90000	0.90000	0.90000	0.80000
0205HACSTPS6	0.90000	0.90000	0.70000	1.00000	0.90000	0.90000	0.90000	1.00000
0205HACSTPS7	1.00000	1.00000	1.00000	1.00000	0.90000	0.90000	0.90000	0.90000

CETIS Analysis Detail

Hyalella 10-d Survival and Growth Sediment Test — **U.S. EPA Region I Lab**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	06-3816-4762	06-3816-4762	21 Apr-05 3:58 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Bonferroni Adj Wilcoxon Rank Sum	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Bartlett	211.10430	20.09024	0.00000	Unequal Variances
Distribution	Kolmogorov-Smirnov D	0.14611	0.12261	0.00070	Non-normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.4054415	0.0506802	8	3.56	0.00189	Significant Effect
Error	0.8837983	0.0142548	62			
Total	1.28923976	0.064935	70			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
0205HACSTLC1		0205HACSTF1	52		0.0524	2	Non-Significant Effect
0205HACSTLC1		0205HACSTPS1	48		0.0190	2	Non-Significant Effect
0205HACSTLC1		0205HACSTPS2	40		0.0361	2	Non-Significant Effect
0205HACSTLC1		0205HACSTPS3	52		0.0524	2	Non-Significant Effect
0205HACSTLC1		0205HACSTPS4	40		0.0099	4	Significant Effect
0205HACSTLC1		0205HACSTPS5	52		0.0524	2	Non-Significant Effect
0205HACSTLC1		0205HACSTPS6	44		0.0052	2	Significant Effect
0205HACSTLC1		0205HACSTPS7	52		0.0524	2	Non-Significant Effect

Data Summary

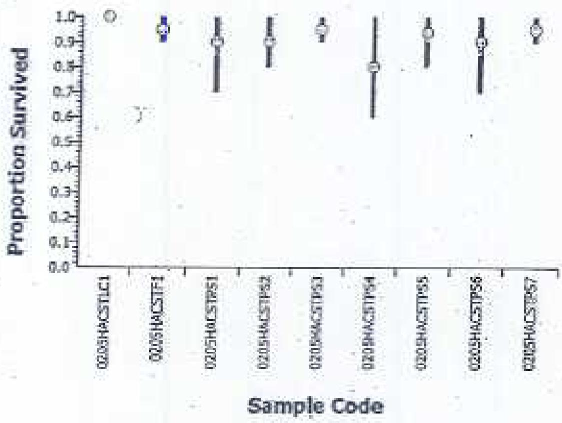
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
0205HACSTLC1	8	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00025
0205HACSTF1	8	0.95000	0.90000	1.00000	0.05345	1.33053	1.24905	1.41202	0.08711
0205HACSTPS1	8	0.90000	0.70000	1.00000	0.10690	1.26019	0.99116	1.41202	0.15368
0205HACSTPS2	7	0.90000	0.80000	1.00000	0.10000	1.25808	1.10715	1.41202	0.15249
0205HACSTPS3	8	0.95000	0.90000	1.00000	0.05345	1.33053	1.24905	1.41202	0.08711
0205HACSTPS4	8	0.80000	0.60000	1.00000	0.13093	1.12410	0.88608	1.41202	0.17184
0205HACSTPS5	8	0.93750	0.80000	1.00000	0.07440	1.31279	1.10715	1.41202	0.11580
0205HACSTPS6	8	0.90000	0.70000	1.00000	0.09258	1.25755	0.99116	1.41202	0.13041
0205HACSTPS7	8	0.95000	0.90000	1.00000	0.05345	1.33053	1.24905	1.41202	0.08711

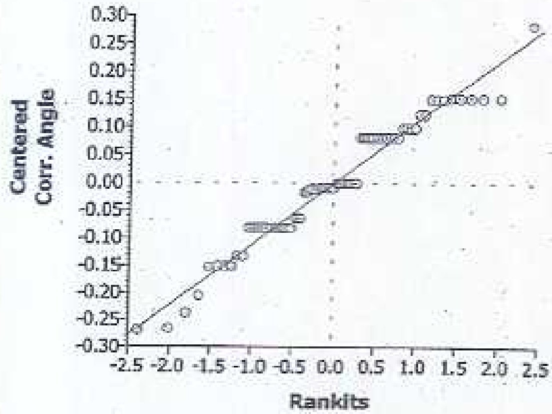
Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0205HACSTLC1	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000		
0205HACSTF1	0.90000	0.90000	1.00000	1.00000	0.90000	1.00000	1.00000	0.90000		
0205HACSTPS1	0.90000	1.00000	1.00000	0.90000	0.80000	0.90000	0.70000	1.00000		
0205HACSTPS2	1.00000	0.80000	1.00000	0.80000	1.00000	0.90000	0.80000			
0205HACSTPS3	1.00000	0.90000	1.00000	1.00000	0.90000	0.90000	1.00000	0.90000		
0205HACSTPS4	0.70000	0.80000	0.70000	0.80000	1.00000	0.60000	0.90000	0.90000		
0205HACSTPS5	1.00000	1.00000	1.00000	1.00000	0.90000	0.90000	0.90000	0.80000		
0205HACSTPS6	0.90000	0.90000	0.70000	1.00000	0.90000	0.90000	0.90000	1.00000		
0205HACSTPS7	1.00000	1.00000	1.00000	1.00000	0.90000	0.90000	0.90000	0.90000		

CETIS Analysis Detail

Graphics





CETIS Analysis Detail

Hyalella 10-d Survival and Growth Sediment Test — **U.S. EPA Region I Lab**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	06-3816-4762	06-3816-4762	21 Apr-05 3:58 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Bonferroni Adj Wilcoxon Rank Sum	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Bartlett	7.06737	18.47531	0.42190	Equal Variances
Distribution	Kolmogorov-Smirnov D	0.18111	0.12995	0.00002	Non-normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.2737571	0.0391082	7	2.43	0.03019	Significant Effect
Error	0.8837983	0.0160691	55			
Total	1.15755540	0.0551772	62			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
0205HACSTF1		0205HACSTPS1	60		0.2209	2	Non-Significant Effect
0205HACSTF1		0205HACSTPS2	48		0.1984	3	Non-Significant Effect
0205HACSTF1		0205HACSTPS3	68		0.4796	2	Non-Significant Effect
0205HACSTF1		0205HACSTPS4	46		0.0103	4	Non-Significant Effect
0205HACSTF1		0205HACSTPS5	66		0.4392	2	Non-Significant Effect
0205HACSTF1		0205HACSTPS6	58		0.1641	2	Non-Significant Effect
0205HACSTF1		0205HACSTPS7	68		0.4796	2	Non-Significant Effect

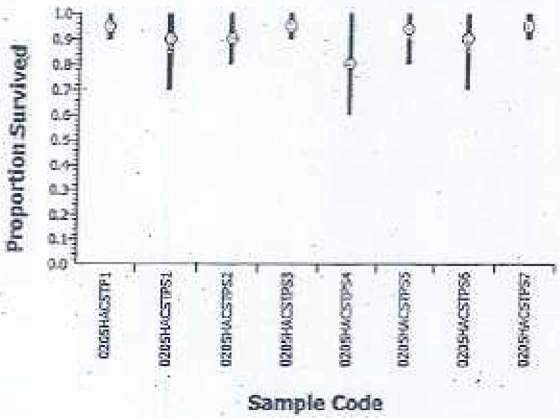
Data Summary

		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
0205HACSTF1	8	0.95000	0.90000	1.00000	0.05345	1.33053	1.24905	1.41202	0.08711
0205HACSTPS1	8	0.90000	0.70000	1.00000	0.10690	1.26019	0.99116	1.41202	0.15368
0205HACSTPS2	7	0.90000	0.80000	1.00000	0.10000	1.25808	1.10715	1.41202	0.15249
0205HACSTPS3	8	0.95000	0.90000	1.00000	0.05345	1.33053	1.24905	1.41202	0.08711
0205HACSTPS4	8	0.80000	0.60000	1.00000	0.13093	1.12410	0.88608	1.41202	0.17184
0205HACSTPS5	8	0.93750	0.80000	1.00000	0.07440	1.31279	1.10715	1.41202	0.11580
0205HACSTPS6	8	0.90000	0.70000	1.00000	0.09258	1.25755	0.99116	1.41202	0.13041
0205HACSTPS7	8	0.95000	0.90000	1.00000	0.05345	1.33053	1.24905	1.41202	0.08711

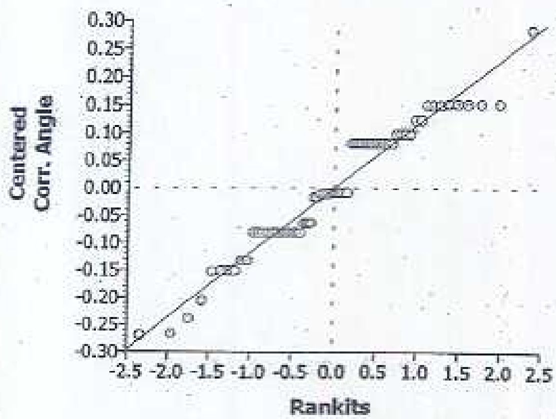
Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0205HACSTF1	0.90000	0.90000	1.00000	1.00000	0.90000	1.00000	1.00000	0.90000		
0205HACSTPS1	0.90000	1.00000	1.00000	0.90000	0.80000	0.90000	0.70000	1.00000		
0205HACSTPS2	1.00000	0.80000	1.00000	0.80000	1.00000	0.90000	0.80000			
0205HACSTPS3	1.00000	0.90000	1.00000	1.00000	0.90000	0.90000	1.00000	0.90000		
0205HACSTPS4	0.70000	0.80000	0.70000	0.80000	1.00000	0.60000	0.90000	0.90000		
0205HACSTPS5	1.00000	1.00000	1.00000	1.00000	0.90000	0.90000	0.90000	0.80000		
0205HACSTPS6	0.90000	0.90000	0.70000	1.00000	0.90000	0.90000	0.90000	1.00000		
0205HACSTPS7	1.00000	1.00000	1.00000	1.00000	0.90000	0.90000	0.90000	0.90000		

Graphics



Proportion Survived
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0205HACSTP1
0205HACSTPS1
0205HACSTPS2
0205HACSTPS3
0205HACSTPS4
0205HACSTPS5
0205HACSTPS6
0205HACSTPS7
Sample Code



Centered
Corr. Angle
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-2.5 -2.0 -1.5 -1.0 -0.5 0.0 0.5 1.0 1.5 2.0 2.5
Rankits

CETIS Analysis Detail

Hyalella 10-d Survival and Growth Sediment Test — **U.S. EPA Region I Lab**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Biomass-mg	Comparison	06-3816-4762	06-3816-4762	21 Apr-05 3:58 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Bonferroni Adj t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Bartlett	11.87206	20.09024	0.15700	Equal Variances
Distribution	Kolmogorov-Smirnov D	0.04794	0.12261	1.00000	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0150142	0.0018768	8	4.42	0.00028	Significant Effect
Error	0.0263140	0.0004244	62			
Total	0.04132824	0.0023012	70			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
0205HACSTLC1		0205HACSTF1	-0.8128	2.57266	0.7903	0.02650	Non-Significant Effect
0205HACSTLC1		0205HACSTPS1	2.14808	2.57266	0.0178	0.02650	Non-Significant Effect
0205HACSTLC1		0205HACSTPS2	2.59434	2.57266	0.0059	0.02743	Significant Effect
0205HACSTLC1		0205HACSTPS3	2.68225	2.57266	0.0047	0.02650	Significant Effect
0205HACSTLC1		0205HACSTPS4	3.61667	2.57266	0.0003	0.02650	Significant Effect
0205HACSTLC1		0205HACSTPS5	0.44929	2.57266	0.3274	0.02650	Non-Significant Effect
0205HACSTLC1		0205HACSTPS6	1.22595	2.57266	0.1124	0.02650	Non-Significant Effect
0205HACSTLC1		0205HACSTPS7	0.23109	2.57266	0.4090	0.02650	Non-Significant Effect

Data Summary

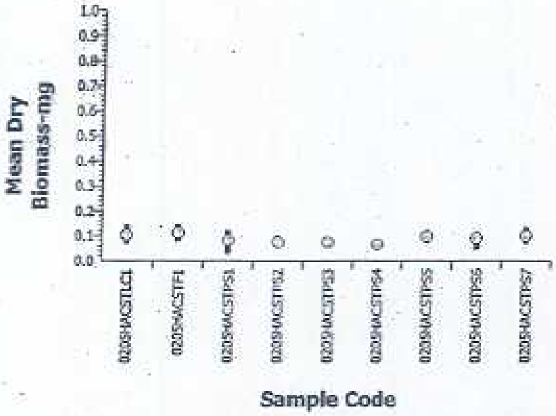
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
0205HACSTLC1	8	0.10238	0.06801	0.14601	0.02657				
0205HACSTF1	8	0.11075	0.07900	0.14800	0.02641				
0205HACSTPS1	8	0.08025	0.03199	0.12001	0.02987				
0205HACSTPS2	7	0.07472	0.06300	0.10300	0.01434				
0205HACSTPS3	8	0.07475	0.05800	0.09500	0.01301				
0205HACSTPS4	8	0.06512	0.04800	0.07799	0.01144				
0205HACSTPS5	8	0.09775	0.07401	0.11899	0.01574				
0205HACSTPS6	8	0.08975	0.04700	0.11600	0.01986				
0205HACSTPS7	8	0.10000	0.06899	0.13400	0.01856				

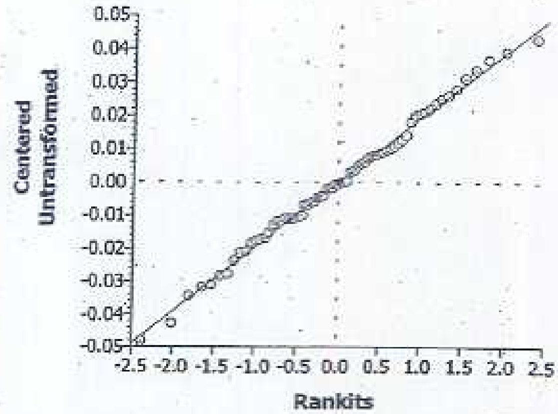
Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0205HACSTLC1	0.08501	0.11200	0.09800	0.13400	0.09199	0.08401	0.14601	0.06801		
0205HACSTF1	0.14800	0.10000	0.11700	0.09000	0.13300	0.07900	0.13600	0.08300		
0205HACSTPS1	0.10400	0.08800	0.05900	0.03199	0.05200	0.10100	0.08600	0.12001		
0205HACSTPS2	0.07500	0.06300	0.08301	0.06801	0.10300	0.06799	0.06300			
0205HACSTPS3	0.08900	0.07800	0.07000	0.07999	0.05800	0.06400	0.09500	0.06400		
0205HACSTPS4	0.06899	0.07799	0.05000	0.07600	0.07400	0.06100	0.06500	0.04800		
0205HACSTPS5	0.11600	0.08700	0.11899	0.10800	0.08500	0.07401	0.09700	0.09600		
0205HACSTPS6	0.09800	0.11600	0.04700	0.09900	0.08900	0.09700	0.08800	0.08400		
0205HACSTPS7	0.09000	0.10299	0.09399	0.13400	0.09800	0.10000	0.06899	0.11200		

CETIS Analysis Detail

Graphics





Report Date: 22 Apr-05 2:40 PM
Analysis: 18-8696-0607/Round 1

CETIS Analysis Detail

Hyalella 10-d Survival and Growth Sediment Test — **U.S. EPA Region I Lab**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Biomass-mg	Comparison	06-3816-4762	06-3816-4762	21 Apr-05 3:58 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Bonferroni Adj t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Bartlett	10.63854	18.47531	0.15518	Equal Variances
Distribution	Kolmogorov-Smirnov D	0.05767	0.12995	0.89993	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0132971	0.0018996	7	4.89	0.00024	Significant Effect
Error	0.0213705	0.0003886	55			
Total	0.03466765	0.0022881	62			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
0205HACSTF1		0205HACSTPS1	3.09452	2.53039	0.0015	0.02494	Significant Effect
0205HACSTF1		0205HACSTPS2	3.53212	2.53039	0.0004	0.02581	Significant Effect
0205HACSTF1		0205HACSTPS3	3.6528	2.53039	0.0003	0.02494	Significant Effect
0205HACSTF1		0205HACSTPS4	4.6294	2.53039	0.0000	0.02494	Significant Effect
0205HACSTF1		0205HACSTPS5	1.31906	2.53039	0.0963	0.02494	Non-Significant Effect
0205HACSTF1		0205HACSTPS6	2.13077	2.53039	0.0188	0.02494	Non-Significant Effect
0205HACSTF1		0205HACSTPS7	1.09101	2.53039	0.1400	0.02494	Non-Significant Effect

Data Summary

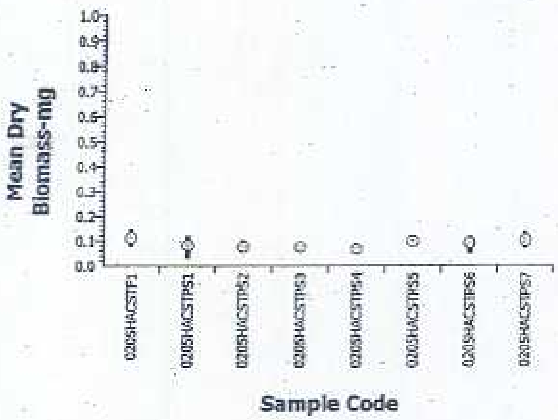
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
0205HACSTF1	8	0.11075	0.07900	0.14800	0.02641				
0205HACSTPS1	8	0.08025	0.03199	0.12001	0.02987				
0205HACSTPS2	7	0.07472	0.06300	0.10300	0.01434				
0205HACSTPS3	8	0.07475	0.05800	0.09500	0.01301				
0205HACSTPS4	8	0.06512	0.04800	0.07799	0.01144				
0205HACSTPS5	8	0.09775	0.07401	0.11899	0.01574				
0205HACSTPS6	8	0.08975	0.04700	0.11600	0.01986				
0205HACSTPS7	8	0.10000	0.06899	0.13400	0.01856				

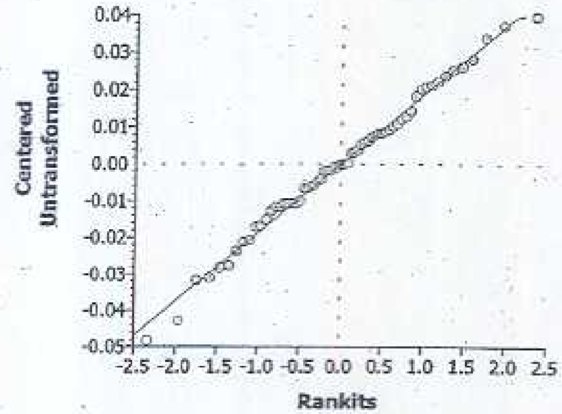
Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0205HACSTF1	0.14800	0.10000	0.11700	0.09000	0.13300	0.07900	0.13600	0.08300		
0205HACSTPS1	0.10400	0.08800	0.05900	0.03199	0.05200	0.10100	0.08600	0.12001		
0205HACSTPS2	0.07500	0.06300	0.08301	0.06801	0.10300	0.06799	0.06300			
0205HACSTPS3	0.08900	0.07800	0.07000	0.07999	0.05800	0.06400	0.09500	0.06400		
0205HACSTPS4	0.06899	0.07799	0.05000	0.07600	0.07400	0.06100	0.06500	0.04800		
0205HACSTPS5	0.11600	0.08700	0.11899	0.10800	0.08500	0.07401	0.09700	0.09600		
0205HACSTPS6	0.09800	0.11600	0.04700	0.09900	0.08900	0.09700	0.08800	0.08400		
0205HACSTPS7	0.09000	0.10299	0.09399	0.13400	0.09800	0.10000	0.06899	0.11200		

CETIS Analysis Detail

Graphics





CETIS Data Worksheet

Report Date: 22 Apr-05 3:12 PM
Link: 15-1902-6066/Round 2

Hyalella 10-d Survival and Growth Sediment Test — **U.S. EPA Region I Lab**

Start Date: 15 Mar-05 **Species:** Hyalella azteca **Sample Code:** 0205HACSTLC2
Ending Date: **Protocol:** EPA/600/R-99/064 (2000) **Sample Source:** Fort Devens LC SD 2
Sample Date: 09 Mar-05 01:53 PM **Material:** LAB ARTIFICIAL SEDIMENT **Sample Station:** LC2

Sample Code	Rep	Pos	# Exposed	# Survived	Total Weight-mg	Tare Weight-mg	Pan Count	Mean Length-mm	Notes
0205HACSTLC2	1		10	10	1204.32	1203.42	10		
0205HACSTLC2	2		10	10	1212.54	1211.77	10		
0205HACSTLC2	3		10	10	1208.68	1208.04	10		
0205HACSTLC2	4		10	10	1207.53	1206.37	10		
0205HACSTLC2	5		10	10	1209.6	1208.81	10		
0205HACSTLC2	6		10	10	1223.96	1223.1	10		
0205HACSTLC2	7		10	10	1204.45	1203.64	10		
0205HACSTLC2	8		10	9	1205.26	1204.65	9		
0205HACSTF1	1		10	9	1217.63	1216.15	9		
0205HACSTF1	2		10	9	1231.46	1230.46	9		
0205HACSTF1	3		10	10	1231.31	1230.14	10		
0205HACSTF1	4		10	10	1242.59	1241.69	10		
0205HACSTF1	5		10	9	1231.51	1230.18	9		
0205HACSTF1	6		10	10	1241.16	1240.37	10		
0205HACSTF1	7		10	10	1237.64	1236.28	10		
0205HACSTF1	8		10	9	1217.26	1216.43	9		
0205HACSTPS8	1		10	9	1214.07	1213.21	9		
0205HACSTPS8	2		10	10	1214.64	1213.71	10		
0205HACSTPS8	3		10	9	1223.01	1222.16	9		
0205HACSTPS8	4		10	9	1213.87	1212.29	9		
0205HACSTPS8	5		10	9	1211.7	1210.75	9		
0205HACSTPS8	6		10	8	1206.48	1205.58	8		
0205HACSTPS8	7		10	10	1204.51	1203.34	10		
0205HACSTPS8	8		10	9	1216.07	1215.2	9		
0205HACSTPS9	1		10	4	1223.87	1223.59	4		
0205HACSTPS9	2		10	5	1232.99	1232.76	5		
0205HACSTPS9	3		10	6	1205.41	1205.01	6		
0205HACSTPS9	4		10	6	1219.38	1218.99	6		
0205HACSTPS9	5		10	8	1211.74	1211.01	8		
0205HACSTPS9	6		10	4	1215.71	1215.44	4		
0205HACSTPS9	7		10	5	1205.56	1205.34	5		
0205HACSTPS9	8		10	1	1201.43	1201.34	1		
0205HACSTPS10	1		10	10	1216.76	1215.79	10		
0205HACSTPS10	2		10	9	1200.3	1199.48	9		
0205HACSTPS10	3		10	9	1202.46	1201.77	9		
0205HACSTPS10	4		10	9	1215.62	1214.86	9		
0205HACSTPS10	5		10	10	1224.3	1223.43	10		
0205HACSTPS10	6		10	10	1218.11	1216.89	10		
0205HACSTPS10	7		10	9	1213.5	1212.36	9		
0205HACSTPS10	8		10	10	1220.09	1219.2	10		
0205HACSTPS11	1		10	6	1211.82	1211.41	6		
0205HACSTPS11	2		10	10	1204.38	1203.55	10		
0205HACSTPS11	3		10	9	1205.11	1204.49	9		
0205HACSTPS11	4		10	9	1220.4	1219.55	9		
0205HACSTPS11	5		10	10	1230.84	1230	10		
0205HACSTPS11	6		10	10	1204.84	1203.89	10		
0205HACSTPS11	7		10	10	1218.55	1217.45	10		
0205HACSTPS11	8		10	7	1229.14	1228.52	7		
0205HACSTG1	1		10	7	1211.38	1210.93	7		
0205HACSTG1	2		11	11	1213.24	1212.39	11		
0205HACSTG1	3		10	9	1224.9	1224.08	9		
0205HACSTG1	4		10	9	1212.05	1211.17	9		
0205HACSTG1	5		10	9	1225.73	1224.99	9		

CETIS Data Worksheet

Report Date: 22 Apr-05 3:12 PM
Link: 15-1902-6066/Round 2

Sample Code	Rep	Pos	# Exposed	# Survived	Total Weight-mg	Tare Weight-mg	Pan Count	Mean Length-mm	Notes
0205HACSTG1	6		10	10	1205.79	1204.06	10		
0205HACSTG1	7		10	10	1207.92	1207.1	10		
0205HACSTG1	8		10	10	1216.14	1215.15	10		
0205HACSTG2	1		10	10	1227.8	1226.51	10		
0205HACSTG2	2		10	10	1207.03	1206.1	10		
0205HACSTG2	3		10	10	1208.69	1207.61	10		
0205HACSTG2	4		10	9	1205.36	1204.29	9		
0205HACSTG2	5		10	10	1214.83	1213.79	10		
0205HACSTG2	6		10	10	1198.51	1197.41	10		
0205HACSTG2	7		10	8	1218.47	1217.77	8		
0205HACSTG2	8		10	10	1207.67	1206.73	10		
0205HACSTG3	2		10	6	1199.84	1199.2	6		
0205HACSTG3	3		10	8	1204.01	1203.32	8		
0205HACSTG3	4		10	10	1200.7	1199.91	10		
0205HACSTG3	5		10	10	1214.4	1213.75	10		
0205HACSTG3	6		10	10	1227.63	1226.81	10		
0205HACSTG3	7		10	7	1203.91	1203.42	7		
0205HACSTG3	8		10	10	1216.22	1215.4	10		

CETIS Test Summary

Report Date: 22 Apr-05 3:22 PM
Link: 06-3816-4762/Round 1

Hyalella 10-d Survival and Growth Sediment Test — **U.S. EPA Region I Lab**

Test No:	13-2527-7965	**Test Type:**	Survival-Growth	**Duration:**	N/A
Start Date:	08 Feb-05	**Protocol:**	EPA/600/R-99/064 (2000)	**Species:**	Hyalella azteca
Ending Date:		**Dil Water:**	None	**Source:**	In-House Culture
Setup Date:	08 Feb-05	**Brine:**			

Comments: Fort Devens Sediment Toxicity Test Round 1

Sample No:	12-4569-5350	**Material:**	Reference sediment	**Client:**	EPA REGION 1
Sample Date:	02 Feb-05 02:10 PM	**Code:**	0205HACSTF1	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens Flannagan SD		
Sample Age:	5d 9h	**Station:**	F1		

Comments: Fort Devens Sediment Toxicity Test

Sample No:	10-5013-8838	**Material:**	LAB ARTIFICIAL SEDIMENT	**Client:**	EPA REGION 1
Sample Date:	07 Feb-05	**Code:**	0205HACSTLC1	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens LC SD 1		
Sample Age:	24h	**Station:**	LC1		

Comments: Fort Devens Sediment Toxicity Test Round 1

Sample No:	06-2559-6491	**Material:**	Site Sediment Sample	**Client:**	EPA REGION 1
Sample Date:	01 Feb-05 04:15 PM	**Code:**	0205HACSTPS1	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens Plow Shop SD		
Sample Age:	6d 7h	**Station:**	PS1		

Comments: Fort Devens Sediment Toxicity Test

Sample No:	15-1307-3691	**Material:**	Site Sediment Sample	**Client:**	EPA REGION 1
Sample Date:	01 Feb-05 03:15 PM	**Code:**	0205HACSTPS2	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens Plow Shop SD		
Sample Age:	6d 8h	**Station:**	PS2		

Comments: Fort Devens Sediment Toxicity Test

Sample No:	02-3051-5023	**Material:**	Site Sediment Sample	**Client:**	EPA REGION 1
Sample Date:	01 Feb-05 02:40 PM	**Code:**	0205HACSTPS3	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens Plow Shop SD		
Sample Age:	6d 9h	**Station:**	PS3		

Comments: Fort Devens Sediment Toxicity Test

Sample No:	07-6595-6937	**Material:**	Site Sediment Sample	**Client:**	EPA REGION 1
Sample Date:	01 Feb-05 02:15 PM	**Code:**	0205HACSTPS4	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens Plow Shop SD		
Sample Age:	6d 9h	**Station:**	PS4		

Comments: Fort Devens Sediment Toxicity Test

Sample No:	18-3003-6058	**Material:**	Site Sediment Sample	**Client:**	EPA REGION 1
Sample Date:	01 Feb-05 01:25 PM	**Code:**	0205HACSTPS5	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens Plow Shop SD		
Sample Age:	6d 10h	**Station:**	PS5		

Comments: Fort Devens Sediment Toxicity Test

Sample No:	11-4943-4728	**Material:**	Site Sediment Sample	**Client:**	EPA REGION 1
Sample Date:	01 Feb-05 01:15 PM	**Code:**	0205HACSTPS6	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens Plow Shop SD		
Sample Age:	6d 10h	**Station:**	PS6		

Comments: Fort Devens Sediment Toxicity Test

CETIS Test Summary

Report Date: 22 Apr-05 3:22 PM
Link: 06-3816-4762/Round 1

Sample No:	10-2222-3442	**Material:**	Site Sediment Sample	**Client:**	EPA REGION 1
Sample Date:	01 Feb-05 12:55 PM	**Code:**	0205HACSTPS7	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens Plow Shop SD		
Sample Age:	6d 11h	**Station:**	PS7		

Comments: Fort Devens Sediment Toxicity Test

Mean Dry Biomass-mg Summary

Sample Code	Reps	Mean	Minimum	Maximum	SE	SD	CV
0205HACSTLC1	8	0.10238	0.06801	0.14601	0.00940	0.02657	25.96%
0205HACSTF1	8	0.11075	0.07900	0.14800	0.00934	0.02641	23.85%
0205HACSTPS1	8	0.08025	0.03199	0.12001	0.01056	0.02987	37.22%
0205HACSTPS2	7	0.07472	0.06300	0.10300	0.00542	0.01434	19.19%
0205HACSTPS3	8	0.07475	0.05800	0.09500	0.00460	0.01301	17.41%
0205HACSTPS4	8	0.06512	0.04800	0.07799	0.00405	0.01144	17.57%
0205HACSTPS5	8	0.09775	0.07401	0.11899	0.00557	0.01574	16.11%
0205HACSTPS6	8	0.08975	0.04700	0.11600	0.00702	0.01986	22.12%
0205HACSTPS7	8	0.10000	0.06899	0.13400	0.00656	0.01856	18.56%

Proportion Survived Summary

Sample Code	Reps	Mean	Minimum	Maximum	SE	SD	CV
0205HACSTLC1	8	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
0205HACSTF1	8	0.95000	0.90000	1.00000	0.01890	0.05345	5.63%
0205HACSTPS1	8	0.90000	0.70000	1.00000	0.03780	0.10690	11.88%
0205HACSTPS2	7	0.90000	0.80000	1.00000	0.03780	0.10000	11.11%
0205HACSTPS3	8	0.95000	0.90000	1.00000	0.01890	0.05345	5.63%
0205HACSTPS4	8	0.80000	0.60000	1.00000	0.04629	0.13093	16.37%
0205HACSTPS5	8	0.93750	0.80000	1.00000	0.02631	0.07440	7.94%
0205HACSTPS6	8	0.90000	0.70000	1.00000	0.03273	0.09258	10.29%
0205HACSTPS7	8	0.95000	0.90000	1.00000	0.01890	0.05345	5.63%

Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0205HACSTLC1	0.08501	0.11200	0.09800	0.13400	0.09199	0.08401	0.14601	0.06801
0205HACSTF1	0.14800	0.10000	0.11700	0.09000	0.13300	0.07900	0.13600	0.08300
0205HACSTPS1	0.10400	0.08800	0.05900	0.03199	0.05200	0.10100	0.08600	0.12001
0205HACSTPS2	0.07500	0.06300	0.08301	0.06801	0.10300	0.06799	0.06300	
0205HACSTPS3	0.08900	0.07800	0.07000	0.07999	0.05800	0.06400	0.09500	0.06400
0205HACSTPS4	0.06899	0.07799	0.05000	0.07600	0.07400	0.06100	0.06500	0.04800
0205HACSTPS5	0.11600	0.08700	0.11899	0.10800	0.08500	0.07401	0.09700	0.09600
0205HACSTPS6	0.09800	0.11600	0.04700	0.09900	0.08900	0.09700	0.08800	0.08400
0205HACSTPS7	0.09000	0.10299	0.09399	0.13400	0.09800	0.10000	0.06899	0.11200

Proportion Survived Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0205HACSTLC1	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
0205HACSTF1	0.90000	0.90000	1.00000	1.00000	0.90000	1.00000	1.00000	0.90000
0205HACSTPS1	0.90000	1.00000	1.00000	0.90000	0.80000	0.90000	0.70000	1.00000
0205HACSTPS2	1.00000	0.80000	1.00000	0.80000	1.00000	0.90000	0.80000	
0205HACSTPS3	1.00000	0.90000	1.00000	1.00000	0.90000	0.90000	1.00000	0.90000
0205HACSTPS4	0.70000	0.80000	0.70000	0.80000	1.00000	0.60000	0.90000	0.90000
0205HACSTPS5	1.00000	1.00000	1.00000	1.00000	0.90000	0.90000	0.90000	0.80000
0205HACSTPS6	0.90000	0.90000	0.70000	1.00000	0.90000	0.90000	0.90000	1.00000
0205HACSTPS7	1.00000	1.00000	1.00000	1.00000	0.90000	0.90000	0.90000	0.90000

CETIS Analysis Detail

Hyalella 10-d Survival and Growth Sediment Test — **U.S. EPA Region I Lab**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	15-1902-6066	15-1902-6066	22 Apr-05 1:59 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Bonferroni Adj Wilcoxon Rank Sum	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Bartlett	25.39852	20.09024	0.00133	Unequal Variances
Distribution	Kolmogorov-Smirnov D	0.13795	0.12261	0.00188	Non-normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	2.245327	0.2806658	8	12.43	0.00000	Significant Effect
Error	1.400303	0.0225855	62			
Total	3.64562964	0.3032514	70			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
0205HACSTLC2		0205HACSTF1	56		0.1172	2	Non-Significant Effect
0205HACSTLC2		0205HACSTPS8	48		0.0190	2	Non-Significant Effect
0205HACSTLC2		0205HACSTPS9	36		0.0001	4	Significant Effect
0205HACSTLC2		0205HACSTPS1	56		0.1172	2	Non-Significant Effect
0205HACSTLC2		0205HACSTPS1	55		0.0974	2	Non-Significant Effect
0205HACSTLC2		0205HACSTG1	59		0.1911	2	Non-Significant Effect
0205HACSTLC2		0205HACSTG2	63.5		0.3227	2	Non-Significant Effect
0205HACSTLC2		0205HACSTG3	46		0.1405	1	Non-Significant Effect

Data Summary

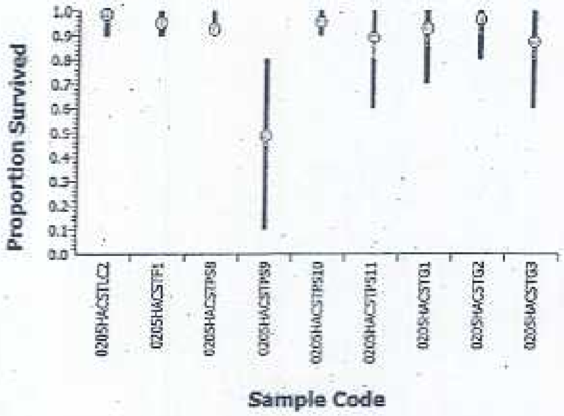
Sample Code	Count	Original Data				Transformed Data			
		Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
0205HACSTLC2	8	0.98750	0.90000	1.00000	0.03536	1.39164	1.24905	1.41202	0.05762
0205HACSTF1	8	0.95000	0.90000	1.00000	0.05345	1.33053	1.24905	1.41202	0.08711
0205HACSTPS8	8	0.92500	0.90000	1.00000	0.04629	1.28979	1.24905	1.41202	0.07544
0205HACSTPS9	8	0.48750	0.10000	0.80000	0.20310	0.76766	0.32175	1.10715	0.22568
0205HACSTPS10	8	0.95000	0.90000	1.00000	0.05345	1.33053	1.24905	1.41202	0.08711
0205HACSTPS11	8	0.88750	0.60000	1.00000	0.15526	1.25292	0.88608	1.41202	0.20852
0205HACSTG1	8	0.92500	0.70000	1.00000	0.10351	1.29923	0.99116	1.41946	0.14884
0205HACSTG2	8	0.96250	0.80000	1.00000	0.07440	1.35354	1.10715	1.41202	0.11473
0205HACSTG3	7	0.87143	0.60000	1.00000	0.17043	1.23321	0.88608	1.41202	0.23197

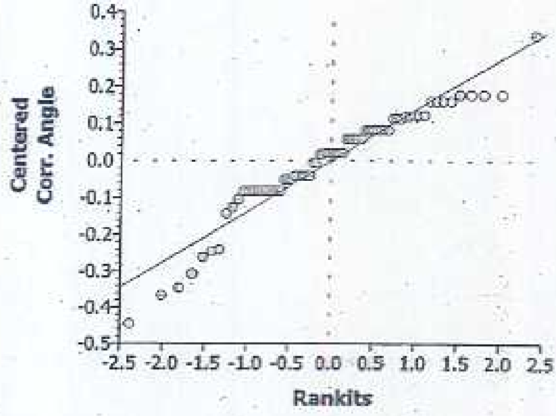
Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0205HACSTLC2	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	0.90000		
0205HACSTF1	0.90000	0.90000	1.00000	1.00000	0.90000	1.00000	1.00000	0.90000		
0205HACSTPS8	0.90000	1.00000	0.90000	0.90000	0.90000	0.90000	1.00000	0.90000		
0205HACSTPS9	0.40000	0.50000	0.60000	0.60000	0.80000	0.40000	0.50000	0.10000		
0205HACSTPS10	1.00000	0.90000	0.90000	0.90000	1.00000	1.00000	0.90000	1.00000		
0205HACSTPS11	0.60000	1.00000	0.90000	0.90000	1.00000	1.00000	1.00000	0.70000		
0205HACSTG1	0.70000	1.00000	0.90000	0.90000	0.90000	1.00000	1.00000	1.00000		
0205HACSTG2	1.00000	1.00000	1.00000	0.90000	1.00000	1.00000	0.80000	1.00000		
0205HACSTG3	0.60000	0.80000	1.00000	1.00000	1.00000	0.70000	1.00000			

CETIS Analysis Detail

Graphics





CETIS Analysis Detail

Hyalella 10-d Survival and Growth Sediment Test — **U.S. EPA Region I Lab**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	15-1902-6066	15-1902-6066	22 Apr-05 1:59 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Bonferroni Adj Wilcoxon Rank Sum	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Bartlett	18.02836	18.47531	0.01184	Equal Variances
Distribution	Kolmogorov-Smirnov D	0.14607	0.12995	0.00190	Non-normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	2.064769	0.294967	7	11.78	0.00000	Significant Effect
Error	1.377063	0.0250375	55			
Total	3.44183242	0.3200045	62			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
0205HACSTF1		0205HACSTPS8	60		0.2209	2	Non-Significant Effect
0205HACSTF1		0205HACSTPS9	36		0.0001	5	Significant Effect
0205HACSTF1		0205HACSTPS1	68		0.4796	2	Non-Significant Effect
0205HACSTF1		0205HACSTPS1	64		0.3605	2	Non-Significant Effect
0205HACSTF1		0205HACSTG1	68		0.4796	2	Non-Significant Effect
0205HACSTF1		0205HACSTG2	74		0.7131	2	Non-Significant Effect
0205HACSTF1		0205HACSTG3	52		0.3472	2	Non-Significant Effect

Data Summary

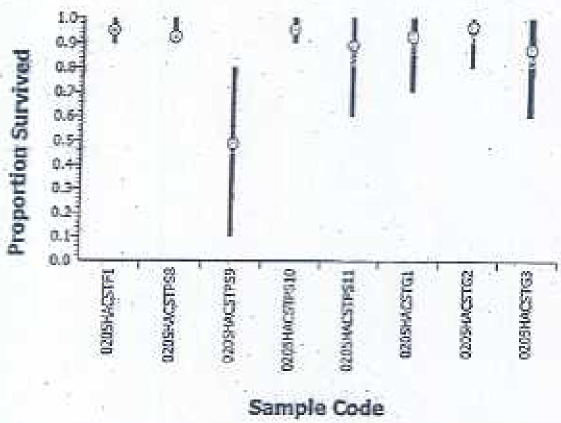
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
0205HACSTF1	8	0.95000	0.90000	1.00000	0.05345	1.33053	1.24905	1.41202	0.08711
0205HACSTPS8	8	0.92500	0.90000	1.00000	0.04629	1.28979	1.24905	1.41202	0.07544
0205HACSTPS9	8	0.48750	0.10000	0.80000	0.20310	0.76766	0.32175	1.10715	0.22568
0205HACSTPS10	8	0.95000	0.90000	1.00000	0.05345	1.33053	1.24905	1.41202	0.08711
0205HACSTPS11	8	0.88750	0.60000	1.00000	0.15526	1.25292	0.88608	1.41202	0.20852
0205HACSTG1	8	0.92500	0.70000	1.00000	0.10351	1.29923	0.99116	1.41946	0.14884
0205HACSTG2	8	0.96250	0.80000	1.00000	0.07440	1.35354	1.10715	1.41202	0.11473
0205HACSTG3	7	0.87143	0.60000	1.00000	0.17043	1.23321	0.88608	1.41202	0.23197

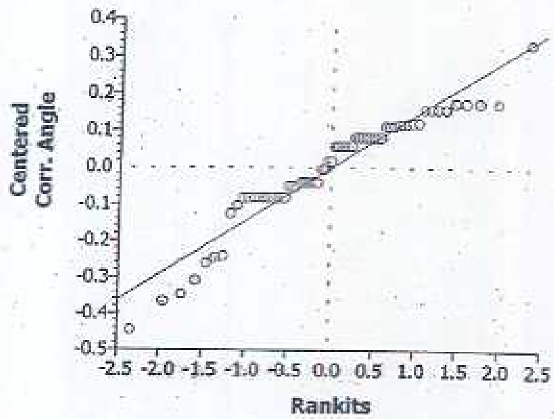
Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0205HACSTF1	0.90000	0.90000	1.00000	1.00000	0.90000	1.00000	1.00000	0.90000		
0205HACSTPS8	0.90000	1.00000	0.90000	0.90000	0.90000	0.90000	1.00000	0.90000		
0205HACSTPS9	0.40000	0.50000	0.60000	0.60000	0.80000	0.40000	0.50000	0.10000		
0205HACSTPS10	1.00000	0.90000	0.90000	0.90000	1.00000	1.00000	0.90000	1.00000		
0205HACSTPS11	0.60000	1.00000	0.90000	0.90000	1.00000	1.00000	1.00000	0.70000		
0205HACSTG1	0.70000	1.00000	0.90000	0.90000	0.90000	1.00000	1.00000	1.00000		
0205HACSTG2	1.00000	1.00000	1.00000	0.90000	1.00000	1.00000	0.80000	1.00000		
0205HACSTG3	1.00000	1.00000	1.00000	0.70000	1.00000	0.60000	0.80000			

CETIS Analysis Detail

Graphics





CETIS Analysis Detail

Report Date: 22 Apr-05 2:11 PM
Analysis: 07-0130-0424/Round 2

Hyalella 10-d Survival and Growth Sediment Test — U.S. EPA Region I Lab

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Biomass-mg	Comparison	15-1902-6066	15-1902-6066	22 Apr-05 1:59 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Bonferroni Adj t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Bartlett	10.41731	20.09024	0.23695	Equal Variances
Distribution	Kolmogorov-Smirnov D	0.11259	0.12261	0.02615	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0344067	0.0043008	8	8.23	0.00000	Significant Effect
Error	0.0323864	0.0005224	62			
Total	0.0667931	0.0048232	70			

Group Comparisons

Sample vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
0205HACSTLC2	0205HACSTF1	-2.7566	2.57266	0.9962	0.0294	Non-Significant Effect
0205HACSTLC2	0205HACSTPS8	-1.9144	2.57266	0.9699	0.0294	Non-Significant Effect
0205HACSTLC2	0205HACSTPS9	4.07961	2.57266	0.0001	0.0294	Significant Effect
0205HACSTLC2	0205HACSTPS1	-1.1159	2.57266	0.8656	0.0294	Non-Significant Effect
0205HACSTLC2	0205HACSTPS1	0.13126	2.57266	0.4480	0.0294	Non-Significant Effect
0205HACSTLC2	0205HACSTG1	-0.9439	2.57266	0.8256	0.0294	Non-Significant Effect
0205HACSTLC2	0205HACSTG2	-1.9799	2.57266	0.9739	0.0294	Non-Significant Effect
0205HACSTLC2	0205HACSTG3	0.78195	2.57266	0.2186	0.03043	Non-Significant Effect

Data Summary

Sample Code	Count	Original Data Mean	Minimum	Maximum	SD	Transformed Data Mean	Minimum	Maximum	SD
0205HACSTLC2	8	0.07925	0.06100	0.11600	0.01858				
0205HACSTF1	8	0.11075	0.07900	0.14800	0.02641				
0205HACSTPS8	8	0.10112	0.08300	0.15800	0.02527				
0205HACSTPS9	8	0.03263	0.00901	0.07300	0.01905				
0205HACSTPS10	8	0.09200	0.06899	0.12200	0.01824				
0205HACSTPS11	8	0.07775	0.04099	0.11001	0.02173				
0205HACSTG1	8	0.09003	0.04500	0.17300	0.03693				
0205HACSTG2	8	0.10187	0.07000	0.12900	0.01702				
0205HACSTG3	7	0.07000	0.04900	0.08199	0.01205				

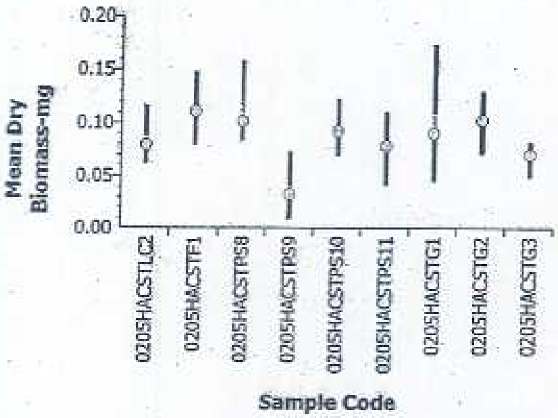
Data Detail

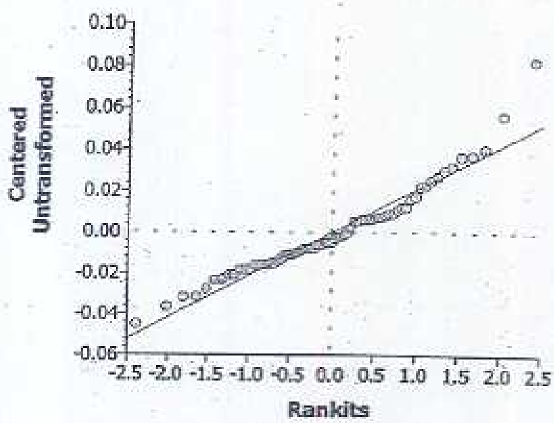
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0205HACSTLC2	0.08999	0.07700	0.06400	0.11600	0.07899	0.08600	0.06100	0.06100		
0205HACSTF1	0.14800	0.10000	0.11700	0.09000	0.13300	0.07900	0.13600	0.08300		
0205HACSTPS8	0.08600	0.09301	0.08300	0.15800	0.09500	0.09000	0.11700	0.08700		
0205HACSTPS9	0.02800	0.02300	0.04000	0.03900	0.07300	0.02700	0.02201	0.00901		
0205HACSTPS10	0.09700	0.08201	0.06899	0.07600	0.08700	0.12200	0.11400	0.08900		
0205HACSTPS11	0.04099	0.08300	0.06200	0.08500	0.08400	0.09500	0.11001	0.06200		
0205HACSTG1	0.04500	0.07727	0.08201	0.08800	0.07400	0.17300	0.08201	0.09900		
0205HACSTG2	0.12900	0.09301	0.10800	0.10699	0.10399	0.11000	0.07000	0.09401		
0205HACSTG3	0.06400	0.06901	0.07899	0.06500	0.08199	0.04900	0.08199			

Analyst:________ Approval:________

CETIS Analysis Detail

Graphics





CETIS Analysis Detail

Hyalella 10-d Survival and Growth Sediment Test — **U.S. EPA Region I Lab**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Biomass-mg	Comparison	15-1902-6066	15-1902-6066	22 Apr-05 1:59 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Bonferroni Adj t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Bartlett	9.86306	18.47531	0.19647	Equal Variances
Distribution	Kolmogorov-Smirnov D	0.11904	0.12995	0.02687	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0341918	0.0048845	7	8.96	0.00000	Significant Effect
Error	0.0299708	0.0005449	55			
Total	0.06416262	0.0054295	62			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
0205HACSTF1		0205HACSTPS8	0.82468	2.53039	0.2066	0.02953	Non-Significant Effect
0205HACSTF1		0205HACSTPS9	6.69322	2.53039	0.0000	0.02953	Significant Effect
0205HACSTF1		0205HACSTPS1	1.60644	2.53039	0.0570	0.02953	Non-Significant Effect
0205HACSTF1		0205HACSTPS1	2.82747	2.53039	0.0033	0.02953	Significant Effect
0205HACSTF1		0205HACSTG1	1.77482	2.53039	0.0407	0.02953	Non-Significant Effect
0205HACSTF1		0205HACSTG2	0.76047	2.53039	0.2251	0.02953	Non-Significant Effect
0205HACSTF1		0205HACSTG3	3.37304	2.53039	0.0007	0.03057	Significant Effect

Data Summary

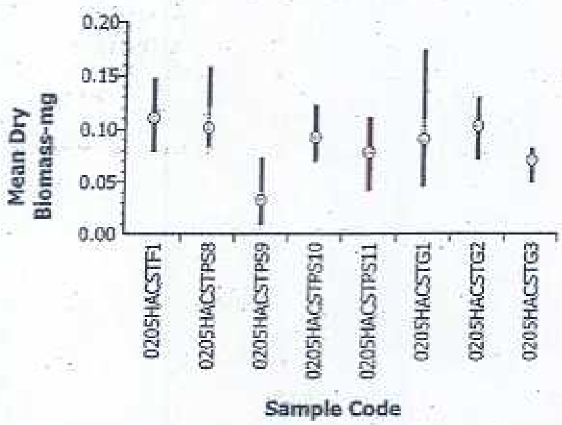
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
0205HACSTF1	8	0.11075	0.07900	0.14800	0.02641				
0205HACSTPS8	8	0.10112	0.08300	0.15800	0.02527				
0205HACSTPS9	8	0.03263	0.00901	0.07300	0.01905				
0205HACSTPS10	8	0.09200	0.06899	0.12200	0.01824				
0205HACSTPS11	8	0.07775	0.04099	0.11001	0.02173				
0205HACSTG1	8	0.09003	0.04500	0.17300	0.03693				
0205HACSTG2	8	0.10187	0.07000	0.12900	0.01702				
0205HACSTG3	7	0.07000	0.04900	0.08199	0.01205				

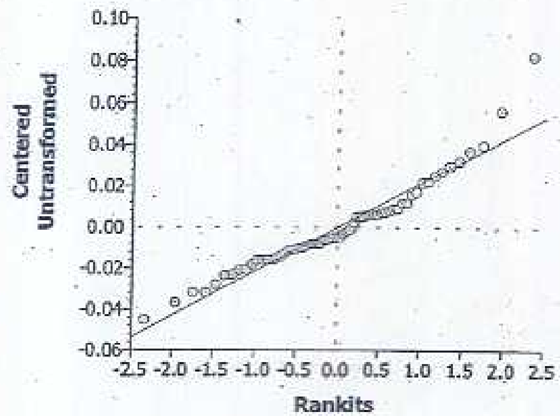
Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0205HACSTF1	0.14800	0.10000	0.11700	0.09000	0.13300	0.07900	0.13600	0.08300		
0205HACSTPS8	0.08600	0.09301	0.08300	0.15800	0.09500	0.09000	0.11700	0.08700		
0205HACSTPS9	0.02800	0.02300	0.04000	0.03900	0.07300	0.02700	0.02201	0.00901		
0205HACSTPS10	0.09700	0.08201	0.06899	0.07600	0.08700	0.12200	0.11400	0.08900		
0205HACSTPS11	0.04099	0.08300	0.06200	0.08500	0.08400	0.09500	0.11001	0.06200		
0205HACSTG1	0.04500	0.07727	0.08201	0.08800	0.07400	0.17300	0.08201	0.09900		
0205HACSTG2	0.12900	0.09301	0.10800	0.10699	0.10399	0.11000	0.07000	0.09401		
0205HACSTG3	0.06400	0.06901	0.07899	0.06500	0.08199	0.04900	0.08199			

CETIS Analysis Detail

Graphics





CETIS Data Worksheet

Report Date: 25 Apr-05 1:53 PM
Link: 17-3527-7025/Round 1

Chironomus 10-d Survival and Growth Sediment Test

U.S. EPA Region I Lab

Start Date: 08 Feb-05
Ending Date:
Sample Date: 07 Feb-05

Species: Chironomus tentans
Protocol: EPA/600/R-99/064 (2000)
Material: LAB ARTIFICIAL SEDIMENT

Sample Code: 0205CTCSTLC1
Sample Source: Fort Devens LC SD 1
Sample Station: LC1

Sample Code	Rep	Pos	# Exposed	# Survived	Total Weight-mg	Ashed Weight-mg	Pan Count	Mean Length-mm	Notes
0205CTCSTLC1	1		10	8	1233.54	1222.17	8		
0205CTCSTLC1	2		10	10	1218.03	1206.7	10		
0205CTCSTLC1	3		10	10	1243.8	1230.49	10		
0205CTCSTLC1	4		10	9	1235.13	1222.65	9		
0205CTCSTLC1	5		10	9	1231.52	1218.93	9		
0205CTCSTLC1	6		10	9	1221.47	1210.34	9		
0205CTCSTLC1	7		10	9	1240.52	1227.85	9		
0205CTCSTLC1	8		10	10	1238.36	1224.2	10		
0205CTCSTF1	1		10	10	1224.18	1215.25	10		
0205CTCSTF1	2		10	10	1218.05	1208.48	10		
0205CTCSTF1	3		10	10	1233.13	1222.68	10		
0205CTCSTF1	4		10	10	1258.27	1249.43	10		
0205CTCSTF1	5		10	10	1224.38	1215.23	10		
0205CTCSTF1	6		10	10	1215.67	1207.81	10		
0205CTCSTF1	7		10	10	1231.91	1222.03	10		
0205CTCSTF1	8		10	10	1233.43	1222.13	10		
0202CTCSTPS1	1		10	9	1220.57	1209.84	9		
0202CTCSTPS1	2		10	10	1216.49	1204.91	10		
0202CTCSTPS1	3		10	10	1254.17	1241.96	10		
0202CTCSTPS1	4		11	11	1227.14	1215.75	11		
0202CTCSTPS1	5		10	10	1235.88	1225.41	10		
0202CTCSTPS1	6		10	10	1240.13	1229.17	10		
0202CTCSTPS1	7		10	10	1236.2	1225.85	10		
0202CTCSTPS1	8		10	10	1243.09	1232.6	10		
0205CTCSTPS2	1		10	10	1224.53	1214.74	10		
0205CTCSTPS2	2		11	11	1254.9	1243.23	11		
0205CTCSTPS2	3		10	10	1227.6	1217.91	10		
0205CTCSTPS2	4		10	10	1233.5	1222.93	10		
0205CTCSTPS2	5		10	10	1219.81	1211.79	10		
0205CTCSTPS2	6		10	10	1215.28	1205.29	10		
0205CTCSTPS2	7		10	10	1250.42	1238.94	10		
0205CTCSTPS2	8		10	10	1236.61	1225.94	10		
0205CTCSTPS3	1		10	8	1244.37	1233.88	8		
0205CTCSTPS3	2		10	10	1237.08	1228.06	10		
0205CTCSTPS3	3		10	10	1218.34	1207.85	10		
0205CTCSTPS3	4		10	10	1226.55	1214.43	10		
0205CTCSTPS3	5		10	10	1244.72	1235.18	10		
0205CTCSTPS3	6		10	10	1243.12	1230.8	10		
0205CTCSTPS3	7		10	10	1232.23	1221.67	10		
0205CTCSTPS3	8		10	10	1224.9	1214.38	10		
0205CTCSTPS4	1		10	10	1249.07	1235.76	10		
0205CTCSTPS4	2		10	10	1230.08	1217.84	10		
0205CTCSTPS4	3		10	9	1263.7	1251.57	9		
0205CTCSTPS4	4		10	10	1245.89	1232.39	10		
0205CTCSTPS4	5		10	10	1238.2	1224.27	10		
0205CTCSTPS4	6		10	10	1220.04	1206.04	10		
0205CTCSTPS4	7		10	10	1217.43	1204.25	10		
0205CTCSTPS4	8		10	10	1256.03	1242.59	10		
0205CTCSTPS5	1		10	9	1213.75	1201.9	9		
0205CTCSTPS5	2		10	10	1215.83	1203.98	10		
0205CTCSTPS5	3		10	9	1247.05	1238.06	9		
0205CTCSTPS5	4		10	9	1215.32	1204.45	9		
0205CTCSTPS5	5		10	10	1220.55	1208.98	10		

CETIS Data Worksheet

Report Date: 25 Apr-05 1:54 PM
Link: 17-3527-7025/Round 1

Sample Code	Rep	Pos	# Exposed	# Survived	Total Weight-mg	Ashed Weight-mg	Pan Count	Mean Length-mm	Notes
0205CTCSTPS5	6		10	10	1222.91	1211.72	10		
0205CTCSTPS5	7		10	8	1223.23	1213	8		
0205CTCSTPS5	8		10	10	1228.58	1217.06	10		
0205CTCSTPS6	1		10	10	1243.63	1231.56	10		
0205CTCSTPS6	2		10	10	1220.58	1209.94	10		
0205CTCSTPS6	3		10	10	1246.66	1233.05	10		
0205CTCSTPS6	4		10	10	1249.72	1236.58	10		
0205CTCSTPS6	5		10	10	1238.61	1228.06	10		
0205CTCSTPS6	6		10	8	1239.93	1230	8		
0205CTCSTPS6	7		10	10	1227.29	1214.45	10		
0205CTCSTPS6	8		10	10	1221.27	1207.39	10		
0205CTCSTPS7	1		10	9	1236.18	1226.78	9		
0205CTCSTPS7	2		10	10	1221.42	1209.62	10		
0205CTCSTPS7	3		11	11	1225.26	1211.66	11		
0205CTCSTPS7	4		10	10	1247.7	1234.7	10		
0205CTCSTPS7	5		10	10	1217.75	1206.65	10		
0205CTCSTPS7	6		10	10	1233.75	1221.6	10		
0205CTCSTPS7	7		10	9	1230.71	1218.5	9		
0205CTCSTPS7	8		10	10	1252.56	1241.51	10		

CETIS Test Summary

Report Date: 25 Apr-05 1:55 PM
Link: 17-3527-7025/Round 1

Chironomus 10-d Survival and Growth Sediment Test — U.S. EPA Region I Lab

Test No:	16-8381-3796	**Test Type:**	Survival-AF Growth	**Duration:**	N/A
Start Date:	08 Feb-05	**Protocol:**	EPA/600/R-99/064 (2000)	**Species:**	Chironomus tentans
Ending Date:		**Dil Water:**	None	**Source:**	In-House Culture
Setup Date:	08 Feb-05	**Brine:**			
Comments:	Devens Sediment Toxicity Test First Round 1				

Sample No:	18-7764-3638	**Material:**	Site Sediment Sample	**Client:**	EPA REGION 1
Sample Date:	01 Feb-05 04:15 PM	**Code:**	0202CTCSTPS1	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens Plow Shop SD		
Sample Age:	6d 7h	**Station:**	PS1		
Comments:	Fort Devens Sediment Toxicity Test				

Sample No:	07-4890-1125	**Material:**	Reference sediment	**Client:**	EPA REGION 1
Sample Date:	02 Feb-05 02:10 PM	**Code:**	0205CTCSTF1	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens Flannagan SD		
Sample Age:	5d 9h	**Station:**	F1		
Comments:	Fort Devens Sediment Toxicity Test				

Sample No:	06-6715-5346	**Material:**	LAB ARTIFICIAL SEDIMENT	**Client:**	EPA REGION 1
Sample Date:	07 Feb-05	**Code:**	0205CTCSTLC1	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens LC SD 1		
Sample Age:	24h	**Station:**	LC1		
Comments:	Fort Devens Sediment Toxicity Test				

Sample No:	05-7079-1092	**Material:**	Site Sediment Sample	**Client:**	EPA REGION 1
Sample Date:	01 Feb-05 03:15 PM	**Code:**	0205CTCSTPS2	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens Plow Shop SD		
Sample Age:	6d 8h	**Station:**	PS2		
Comments:	Fort Devens Sediment Toxicity Test				

Sample No:	03-6846-3737	**Material:**	Site Sediment Sample	**Client:**	EPA REGION 1
Sample Date:	01 Feb-05 02:40 PM	**Code:**	0205CTCSTPS3	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens Plow Shop SD		
Sample Age:	6d 9h	**Station:**	PS3		
Comments:	Fort Devens Sediment Toxicity Test				

Sample No:	01-6054-7316	**Material:**	Site Sediment Sample	**Client:**	EPA REGION 1
Sample Date:	01 Feb-05 02:15 PM	**Code:**	0205CTCSTPS4	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens Plow Shop SD		
Sample Age:	6d 9h	**Station:**	PS4		
Comments:	Fort Devens Sediment Toxicity Test				

Sample No:	09-7663-6141	**Material:**	Site Sediment Sample	**Client:**	EPA REGION 1
Sample Date:	01 Feb-05 01:25 PM	**Code:**	0205CTCSTPS5	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens Plow Shop SD		
Sample Age:	6d 10h	**Station:**	PS5		
Comments:	Fort Devens Sediment Toxicity Test				

Sample No:	07-0182-6113	**Material:**	Site Sediment Sample	**Client:**	EPA REGION 1
Sample Date:	01 Feb-05 01:15 PM	**Code:**	0205CTCSTPS6	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens Plow Shop SD		
Sample Age:	6d 10h	**Station:**	PS6		
Comments:	Fort Devens Sediment Toxicity Test				

CETIS Test Summary

Report Date: 25 Apr-05 1:55 PM
Link: 17-3527-7025/Round 1

Sample No:	04-0046-0821	**Material:**	Site Sediment Sample	**Client:**	EPA REGION 1
Sample Date:	01 Feb-05 12:55 PM	**Code:**	0205CTCSTPS7	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens Plow Shop SD		
Sample Age:	6d 11h	**Station:**	PS7		

Comments: Fort Devens Sediment Toxicity Test

Mean AF Biomass-mg Summary

Sample Code	Reps	Mean	Minimum	Maximum	SE	SD	CV
0205CTCSTLC1	8	1.23800	1.11300	1.41600	0.03746	0.10594	8.56%
0205CTCSTF1	8	0.94975	0.78600	1.13000	0.03747	0.10600	11.16%
0202CTCSTPS1	8	1.08931	1.03500	1.22101	0.02377	0.06723	6.17%
0205CTCSTPS2	8	1.01024	0.80200	1.14801	0.03614	0.10221	10.12%
0205CTCSTPS3	8	1.06325	0.90199	1.23199	0.03989	0.11284	10.61%
0205CTCSTPS4	8	1.29662	1.19299	1.40000	0.02687	0.07599	5.86%
0205CTCSTPS5	8	1.12738	1.02300	1.18700	0.01998	0.05651	5.01%
0205CTCSTPS6	8	1.20750	0.99301	1.38800	0.05368	0.15184	12.57%
0205CTCSTPS7	8	1.16342	0.94000	1.30000	0.03928	0.11110	9.55%

Proportion Survived Summary

Sample Code	Reps	Mean	Minimum	Maximum	SE	SD	CV
0205CTCSTLC1	8	0.92500	0.80000	1.00000	0.02500	0.07071	7.64%
0205CTCSTF1	8	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
0202CTCSTPS1	8	0.98750	0.90000	1.00000	0.01250	0.03536	3.58%
0205CTCSTPS2	8	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
0205CTCSTPS3	8	0.97500	0.80000	1.00000	0.02500	0.07071	7.25%
0205CTCSTPS4	8	0.98750	0.90000	1.00000	0.01250	0.03536	3.58%
0205CTCSTPS5	8	0.93750	0.80000	1.00000	0.02631	0.07440	7.94%
0205CTCSTPS6	8	0.97500	0.80000	1.00000	0.02500	0.07071	7.25%
0205CTCSTPS7	8	0.97500	0.90000	1.00000	0.01637	0.04629	4.75%

Mean AF Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0205CTCSTLC1	1.13700	1.13301	1.33101	1.24800	1.25900	1.11300	1.26700	1.41600
0205CTCSTF1	0.89301	0.95701	1.04500	0.88400	0.91500	0.78600	0.98800	1.13000
0202CTCSTPS1	1.07300	1.15800	1.22101	1.03546	1.04700	1.09600	1.03500	1.04900
0205CTCSTPS2	0.97900	1.06091	0.96899	1.05699	0.80200	0.99900	1.14801	1.06700
0205CTCSTPS3	1.04900	0.90199	1.04900	1.21200	0.95399	1.23199	1.05599	1.05200
0205CTCSTPS4	1.33099	1.22400	1.21300	1.35000	1.19299	1.40000	1.31801	1.34401
0205CTCSTPS5	1.18500	1.18700	1.09900	1.08700	1.15701	1.11901	1.02300	1.16200
0205CTCSTPS6	1.20699	1.06400	1.35499	1.31400	1.05499	0.99301	1.28401	1.38800
0205CTCSTPS7	0.94000	1.18000	1.23636	1.30000	1.11000	1.21500	1.22100	1.10500

Proportion Survived Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0205CTCSTLC1	0.80000	1.00000	1.00000	0.90000	0.90000	0.90000	0.90000	1.00000
0205CTCSTF1	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
0202CTCSTPS1	0.90000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
0205CTCSTPS2	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
0205CTCSTPS3	0.80000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
0205CTCSTPS4	1.00000	1.00000	0.90000	1.00000	1.00000	1.00000	1.00000	1.00000
0205CTCSTPS5	0.90000	1.00000	0.90000	0.90000	1.00000	1.00000	0.80000	1.00000
0205CTCSTPS6	1.00000	1.00000	1.00000	1.00000	1.00000	0.80000	1.00000	1.00000
0205CTCSTPS7	0.90000	1.00000	1.00000	1.00000	1.00000	1.00000	0.90000	1.00000

Report Date: 25 Apr-05 1:58 PM
Analysis: 07-4612-5367/Round 1

CETIS Analysis Detail

Chironomus 10-d Survival and Growth Sediment Test — U.S. EPA Region I Lab

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	17-3527-7025	17-3527-7025	28 Mar-05 11:05 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Steel's Many-One Rank	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Bartlett	246.42500	20.09024	0.00000	Unequal Variances
Distribution	Kolmogorov-Smirnov D	0.28689	0.12177	0.00000	Non-normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.1112961	0.0139120	8	2.04	0.05514	Non-Significant Effect
Error	0.428648	0.0068039	63			
Total	0.53994408	0.0207159	71			

Group Comparisons

Sample vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
0205CTCSTLC1	0205CTCSTF1	88	45	> 0.0500	2	Non-Significant Effect
0205CTCSTLC1	0202CTCSTPS1	86	45	> 0.0500	2	Non-Significant Effect
0205CTCSTLC1	0205CTCSTPS2	89.5	45	> 0.0500	2	Non-Significant Effect
0205CTCSTLC1	0205CTCSTPS3	82	45	> 0.0500	3	Non-Significant Effect
0205CTCSTLC1	0205CTCSTPS4	84.5	45	> 0.0500	2	Non-Significant Effect
0205CTCSTLC1	0205CTCSTPS5	71.5	45	> 0.0500	3	Non-Significant Effect
0205CTCSTLC1	0205CTCSTPS6	82	45	> 0.0500	3	Non-Significant Effect
0205CTCSTLC1	0205CTCSTPS7	82.5	45	> 0.0500	2	Non-Significant Effect

Data Summary

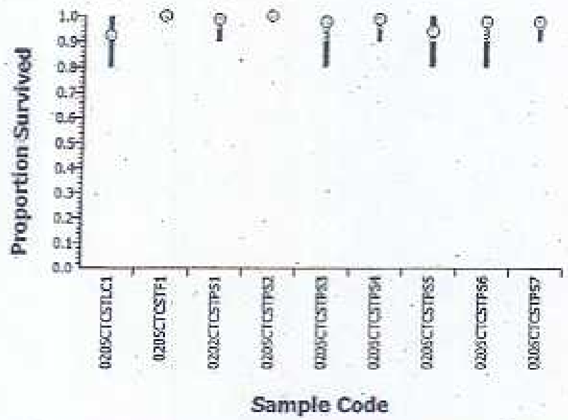
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
0205CTCSTLC1	8	0.92500	0.80000	1.00000	0.07071	1.29242	1.10715	1.41202	0.11004
0205CTCSTF1	8	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00025
0202CTCSTPS1	8	0.98750	0.90000	1.00000	0.03536	1.39258	1.24905	1.41946	0.05605
0205CTCSTPS2	8	1.00000	1.00000	1.00000	0.00000	1.41295	1.41202	1.41946	0.00265
0205CTCSTPS3	8	0.97500	0.80000	1.00000	0.07071	1.37391	1.10715	1.41202	0.10779
0205CTCSTPS4	8	0.98750	0.90000	1.00000	0.03536	1.39164	1.24905	1.41202	0.05762
0205CTCSTPS5	8	0.93750	0.80000	1.00000	0.07440	1.31279	1.10715	1.41202	0.11580
0205CTCSTPS6	8	0.97500	0.80000	1.00000	0.07071	1.37391	1.10715	1.41202	0.10779
0205CTCSTPS7	8	0.97500	0.90000	1.00000	0.04629	1.37220	1.24905	1.41946	0.07606

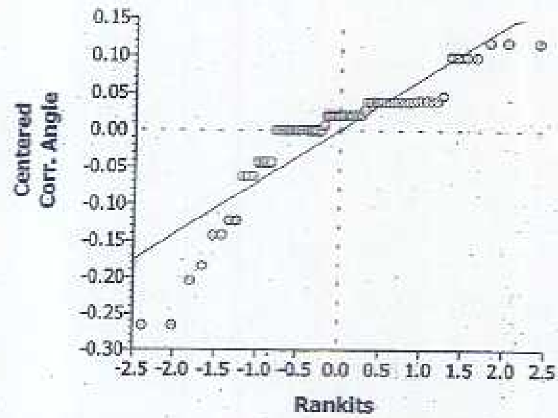
Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0205CTCSTLC1	0.80000	1.00000	1.00000	0.90000	0.90000	0.90000	0.90000	1.00000		
0205CTCSTF1	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000		
0202CTCSTPS1	0.90000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000		
0205CTCSTPS2	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000		
0205CTCSTPS3	0.80000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000		
0205CTCSTPS4	1.00000	1.00000	0.90000	1.00000	1.00000	1.00000	1.00000	1.00000		
0205CTCSTPS5	0.90000	1.00000	0.90000	0.90000	1.00000	1.00000	0.80000	1.00000		
0205CTCSTPS6	1.00000	1.00000	1.00000	1.00000	1.00000	0.80000	1.00000	1.00000		
0205CTCSTPS7	0.90000	1.00000	1.00000	1.00000	1.00000	1.00000	0.90000	1.00000		

CETIS Analysis Detail

Graphics





Report Date: 25 Apr-05 2:01 PM
Analysis: 07-4912-9473/Round 1

CETIS Analysis Detail

Chironomus 10-d Survival and Growth Sediment Test — U.S. EPA Region I Lab

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	17-3527-7025	17-3527-7025	28 Mar-05 11:06 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Steel's Many-One Rank	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Bartlett	244.64990	18.47531	0.00000	Unequal Variances
Distribution	Kolmogorov-Smirnov D	0.33872	0.12896	0.00000	Non-normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0564437	0.0080634	7	1.31	0.26131	Non-Significant Effect
Error	0.3438876	0.0061408	56			
Total	0.40033131	0.0142042	63			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
0205CTCSTF1		0202CTCSTPS1	68	45	> 0.0500	1	Non-Significant Effect
0205CTCSTF1		0205CTCSTPS2	72	45	> 0.0500	1	Non-Significant Effect
0205CTCSTF1		0205CTCSTPS3	64	45	> 0.0500	1	Non-Significant Effect
0205CTCSTF1		0205CTCSTPS4	64	45	> 0.0500	1	Non-Significant Effect
0205CTCSTF1		0205CTCSTPS5	52	45	> 0.0500	2	Non-Significant Effect
0205CTCSTF1		0205CTCSTPS6	64	45	> 0.0500	1	Non-Significant Effect
0205CTCSTF1		0205CTCSTPS7	64	45	> 0.0500	2	Non-Significant Effect

Data Summary

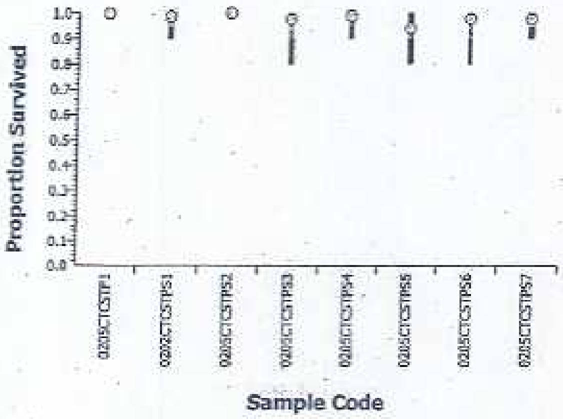
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
0205CTCSTF1	8	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00025
0202CTCSTPS1	8	0.98750	0.90000	1.00000	0.03536	1.39258	1.24905	1.41946	0.05805
0205CTCSTPS2	8	1.00000	1.00000	1.00000	0.00000	1.41295	1.41202	1.41946	0.00265
0205CTCSTPS3	8	0.97500	0.80000	1.00000	0.07071	1.37391	1.10715	1.41202	0.10779
0205CTCSTPS4	8	0.98750	0.90000	1.00000	0.03536	1.39164	1.24905	1.41202	0.05762
0205CTCSTPS5	8	0.93750	0.80000	1.00000	0.07440	1.31279	1.10715	1.41202	0.11580
0205CTCSTPS6	8	0.97500	0.80000	1.00000	0.07071	1.37391	1.10715	1.41202	0.10779
0205CTCSTPS7	8	0.97500	0.90000	1.00000	0.04629	1.37220	1.24905	1.41946	0.07606

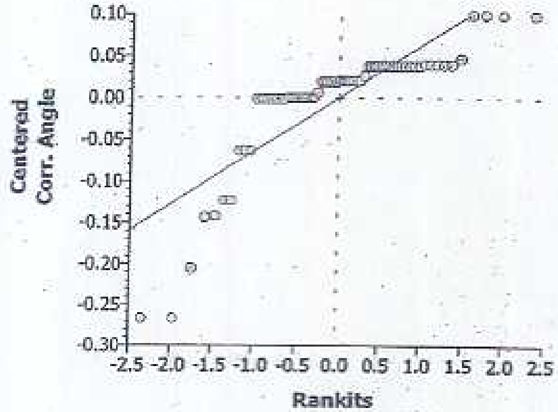
Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0205CTCSTF1	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000		
0202CTCSTPS1	0.90000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000		
0205CTCSTPS2	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000		
0205CTCSTPS3	0.80000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000		
0205CTCSTPS4	1.00000	1.00000	0.90000	1.00000	1.00000	1.00000	1.00000	1.00000		
0205CTCSTPS5	0.90000	1.00000	0.90000	0.90000	1.00000	1.00000	0.80000	1.00000		
0205CTCSTPS6	1.00000	1.00000	1.00000	1.00000	1.00000	0.80000	1.00000	1.00000		
0205CTCSTPS7	0.90000	1.00000	1.00000	1.00000	1.00000	1.00000	0.90000	1.00000		

CETIS Analysis Detail

Graphics





CETIS Analysis Detail

Report Date: 25 Apr-05 2:05 PM
Analysis: 18-0483-0887/Round 1

Chironomus 10-d Survival and Growth Sediment Test — U.S. EPA Region I Lab

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean AF Biomass-mg	Comparison	17-3527-7025	17-3527-7025	24 Mar-05 11:24 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Dunnett's Multiple Comparison	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Bartlett	10.11309	20.09024	0.25718	Equal Variances
Distribution	Kolmogorov-Smirnov D	0.05355	0.12177	0.90437	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.7748421	0.0968553	8	8.57	0.00000	Significant Effect
Error	0.7119169	0.0113003	63			
Total	1.48675901	0.1081556	71			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
0205CTCSTLC1		0205CTCSTF1	5.42321	2.43714	<= 0.0500	0.12954	Significant Effect
0205CTCSTLC1		0202CTCSTPS1	2.55408	2.43714	<= 0.0500	0.12954	Significant Effect
0205CTCSTLC1		0205CTCSTPS2	4.03565	2.43714	<= 0.0500	0.12954	Significant Effect
0205CTCSTLC1		0205CTCSTPS3	3.28789	2.43714	<= 0.0500	0.12954	Significant Effect
0205CTCSTLC1		0205CTCSTPS4	-1.1029	2.43714	> 0.0500	0.12954	Non-Significant Effect
0205CTCSTLC1		0205CTCSTPS5	2.08134	2.43714	> 0.0500	0.12954	Non-Significant Effect
0205CTCSTLC1		0205CTCSTPS6	0.57388	2.43714	> 0.0500	0.12954	Non-Significant Effect
0205CTCSTLC1		0205CTCSTPS7	1.11241	2.43714	> 0.0500	0.12954	Non-Significant Effect

Data Summary

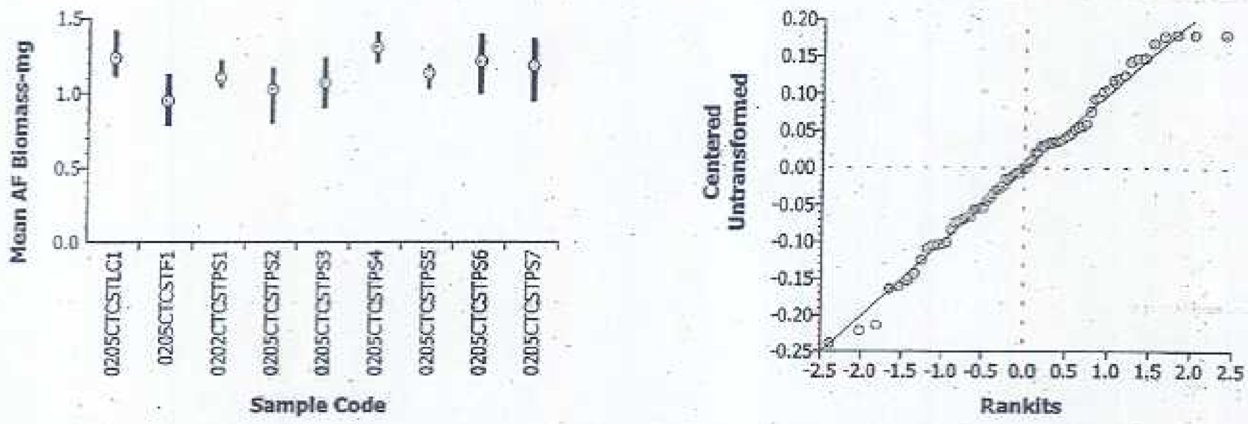
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
0205CTCSTLC1	8	1.23800	1.11300	1.41600	0.10594				
0205CTCSTF1	8	0.94975	0.78600	1.13000	0.10599				
0202CTCSTPS1	8	1.10225	1.03500	1.22101	0.06532				
0205CTCSTPS2	8	1.02350	0.80200	1.16700	0.11571				
0205CTCSTPS3	8	1.06325	0.90199	1.23199	0.11284				
0205CTCSTPS4	8	1.29662	1.19299	1.40000	0.07599				
0205CTCSTPS5	8	1.12738	1.02300	1.18700	0.05651				
0205CTCSTPS6	8	1.20750	0.99301	1.38800	0.15184				
0205CTCSTPS7	8	1.17888	0.94000	1.36000	0.12974				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0205CTCSTLC1	1.13700	1.13301	1.33101	1.24800	1.25900	1.11300	1.26700	1.41600		
0205CTCSTF1	0.89301	0.95701	1.04500	0.88400	0.91500	0.78600	0.98800	1.13000		
0202CTCSTPS1	1.07300	1.15800	1.22101	1.13900	1.04700	1.09600	1.03500	1.04900		
0205CTCSTPS2	0.97900	1.16700	0.96899	1.05699	0.80200	0.99900	1.14801	1.06700		
0205CTCSTPS3	1.04900	0.90199	1.04900	1.21200	0.95399	1.23199	1.05599	1.05200		
0205CTCSTPS4	1.33099	1.22400	1.21300	1.35000	1.19299	1.40000	1.31801	1.34401		
0205CTCSTPS5	1.18500	1.18700	1.09900	1.08700	1.15701	1.11901	1.02300	1.16200		
0205CTCSTPS6	1.20699	1.06400	1.35499	1.31400	1.05499	0.99301	1.28401	1.38800		
0205CTCSTPS7	0.94000	1.18000	1.36000	1.30000	1.11000	1.21500	1.22100	1.10500		

CETIS Analysis Detail

Graphics



CETIS Analysis Detail

Chironomus 10-d Survival and Growth Sediment Test — **U.S. EPA Region I Lab**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean AF Biomass-mg	Comparison	17-3527-7025	17-3527-7025	24 Mar-05 11:24 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Dunnett's Multiple Comparison	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Bartlett	10.10657	18.47531	0.18261	Equal Variances
Distribution	Kolmogorov-Smirnov D	0.05876	0.12896	0.85860	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.673529	0.0962184	7	8.51	0.00000	Significant Effect
Error	0.6333501	0.0113098	56			
Total	1.30687910	0.1075282	63			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
0205CTCSTF1		0202CTCSTPS1	-2.8679	2.39429	> 0.0500	0.12731	Non-Significant Effect
0205CTCSTF1		0205CTCSTPS2	-1.387	2.39429	> 0.0500	0.12731	Non-Significant Effect
0205CTCSTF1		0205CTCSTPS3	-2.1344	2.39429	> 0.0500	0.12731	Non-Significant Effect
0205CTCSTF1		0205CTCSTPS4	-6.5234	2.39429	> 0.0500	0.12731	Non-Significant Effect
0205CTCSTF1		0205CTCSTPS5	-3.3405	2.39429	> 0.0500	0.12731	Non-Significant Effect
0205CTCSTF1		0205CTCSTPS6	-4.8473	2.39429	> 0.0500	0.12731	Non-Significant Effect
0205CTCSTF1		0205CTCSTPS7	-4.309	2.39429	> 0.0500	0.12731	Non-Significant Effect

Data Summary

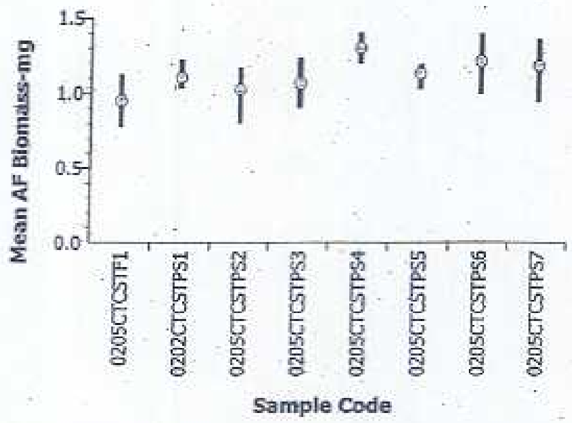
Sample Code	Count	Original Data				Transformed Data			
		Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
0205CTCSTF1	8	0.94975	0.78600	1.13000	0.10599				
0202CTCSTPS1	8	1.10225	1.03500	1.22101	0.06532				
0205CTCSTPS2	8	1.02350	0.80200	1.16700	0.11571				
0205CTCSTPS3	8	1.06325	0.90199	1.23199	0.11284				
0205CTCSTPS4	8	1.29662	1.19299	1.40000	0.07599				
0205CTCSTPS5	8	1.12738	1.02300	1.18700	0.05651				
0205CTCSTPS6	8	1.20750	0.99301	1.38800	0.15184				
0205CTCSTPS7	8	1.17888	0.94000	1.36000	0.12974				

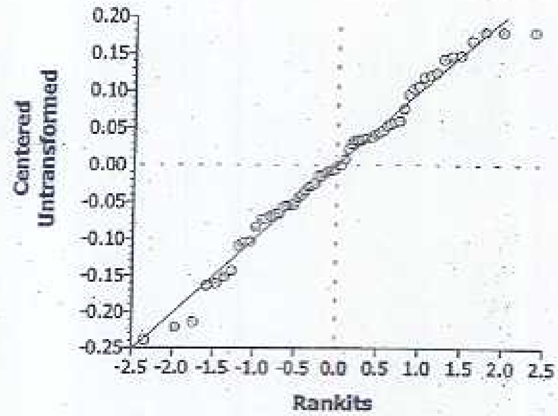
Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0205CTCSTF1	0.89301	0.95701	1.04500	0.88400	0.91500	0.78600	0.98800	1.13000		
0202CTCSTPS1	1.07300	1.15800	1.22101	1.13900	1.04700	1.09600	1.03500	1.04900		
0205CTCSTPS2	0.97900	1.16700	0.96899	1.05699	0.80200	0.99900	1.14801	1.06700		
0205CTCSTPS3	1.04900	0.90199	1.04900	1.21200	0.95399	1.23199	1.05599	1.05200		
0205CTCSTPS4	1.33099	1.22400	1.21300	1.35000	1.19299	1.40000	1.31801	1.34401		
0205CTCSTPS5	1.18500	1.18700	1.09900	1.08700	1.15701	1.11901	1.02300	1.16200		
0205CTCSTPS6	1.38800	1.20699	1.06400	1.35499	1.31400	1.05499	0.99301	1.28401		
0205CTCSTPS7	0.94000	1.18000	1.36000	1.30000	1.11000	1.21500	1.22100	1.10500		

CETIS Analysis Detail

Graphics





CETIS Data Worksheet

Report Date: 25 Apr-05 1:25 PM
Link: 12-2945-4726/Round 2

Chironomus 10-d Survival and Growth Sediment Test

U.S. EPA Region I Lab

Start Date: 14 Mar-05
Ending Date:
Sample Date: 07 Feb-05

Species: Chironomus tentans
Protocol: EPA/600/R-99/064 (2000)
Material: LAB ARTIFICIAL SEDIMENT

Sample Code: 0205CTCSTLC2
Sample Source: Fort Devens LC SD 2
Sample Station: LC2

Sample Code	Rep	Pos	# Exposed	# Survived	Total Weight-mg	Ashed Weight-mg	Pan Count	Mean Length-mm	Notes
0205CTCSTLC2	1		10	8	1212.39	1204.46	8		
0205CTCSTLC2	2		10	10	1234.94	1223.02	10		
0205CTCSTLC2	3		10	9	1231.76	1220.7	9		
0205CTCSTLC2	4		10	9	1235.59	1226.56	9		
0205CTCSTLC2	5		10	7	1216.63	1208.58	7		
0205CTCSTLC2	6		10	7	1220.44	1211.22	7		
0205CTCSTLC2	7		10	9	1223.46	1213.49	9		
0205CTCSTLC2	8		10	9	1215.18	1206.62	9		
0205CTCSTF1	1		10	10	1224.18	1215.25	10		
0205CTCSTF1	2		10	10	1218.05	1208.48	10		
0205CTCSTF1	3		10	10	1233.13	1222.68	10		
0205CTCSTF1	4		10	10	1258.27	1249.43	10		
0205CTCSTF1	5		10	10	1224.38	1215.23	10		
0205CTCSTF1	6		10	10	1215.67	1207.81	10		
0205CTCSTF1	7		10	10	1231.91	1222.03	10		
0205CTCSTF1	8		10	10	1233.43	1222.13	10		
0205CTCSTPS8	1		10	10	1218.01	1208.34	10		
0205CTCSTPS8	2		10	10	1235.77	1227.61	10		
0205CTCSTPS8	3		10	9	1227.07	1218.5	9		
0205CTCSTPS8	4		10	10	1220.02	1213.02	10		
0205CTCSTPS8	5		10	8	1228.35	1219.93	8		
0205CTCSTPS8	6		10	8	1213.16	1205.63	8		
0205CTCSTPS8	7		10	9	1215.94	1206.96	9		
0205CTCSTPS8	8		10	9	1215.39	1206.97	9		
0205CTCSTPS9	1		10	3	1220.26	1219.82	3		
0205CTCSTPS9	2		10	4	1224.09	1223.38	4		
0205CTCSTPS9	3		10	6	1227.07	1225.54	6		
0205CTCSTPS9	4		10	2	1223.6	1223.4	2		
0205CTCSTPS9	5		10	3	1218.55	1218.21	3		
0205CTCSTPS9	6		10	8	1203.78	1202.59	8		
0205CTCSTPS9	7		10	7	1217.85	1216.4	7		
0205CTCSTPS9	8		10	3	1225.28	1224.55	3		
0205CTCSTPS10	1		10	10	1216.95	1208.81	10		
0205CTCSTPS10	2		10	9	1221.14	1211.59	9		
0205CTCSTPS10	3		10	10	1225.33	1215.68	10		
0205CTCSTPS10	4		10	8	1221.12	1212.46	8		
0205CTCSTPS10	5		10	10	1225.43	1214.1	10		
0205CTCSTPS10	6		12	12	1229.99	1216.72	12		
0205CTCSTPS10	7		10	9	1235.87	1228.05	9		
0205CTCSTPS10	8		10	10	1220.94	1209.14	10		
0205CTCSTPS11	1		10	10	1217.73	1209.71	10		
0205CTCSTPS11	2		10	8	1216.3	1206.17	8		
0205CTCSTPS11	3		10	8	1234.14	1225.65	8		
0205CTCSTPS11	4		10	9	1231.04	1220.35	9		
0205CTCSTPS11	5		10	10	1215.8	1203.2	10		
0205CTCSTPS11	6		10	9	1219.8	1210.17	9		
0205CTCSTPS11	7		10	10	1230.52	1220.61	10		
0205CTCSTPS11	8		10	8	1221.45	1209.93	8		
0205CTCSTG1	1		10	8	1237.12	1229.39	8		
0205CTCSTG1	2		10	10	1235.66	1227.35	10		
0205CTCSTG1	3		10	9	1217.84	1209.69	9		
0205CTCSTG1	4		10	9	1235.95	1225.46	9		
0205CTCSTG1	5		10	10	1222.05	1210.51	10		

Analyst:________ Reviewed By:________

CETIS Data Worksheet

Report Date: 25 Apr-05 1:25 PM
Link: 12-2945-4726/Round 2

Sample Code	Rep	Pos	# Exposed	# Survived	Total Weight-mg	Ashed Weight-mg	Pan Count	Mean Length-mm	Notes
0205CTCSTG1	6		10	10	1233.39	1225.32	10		
0205CTCSTG1	7		10	9	1229.87	1221.26	9		
0205CTCSTG1	8		10	9	1223.82	1212.48	9		
0205CTCSTG2	1		10	10	1219.65	1211.86	10		
0205CTCSTG2	2		10	10	1214.52	1206.14	10		
0205CTCSTG2	3		10	10	1223.93	1215.06	10		
0205CTCSTG2	4		10	10	1215.29	1207.14	10		
0205CTCSTG2	5		10	9	1229.38	1220.21	9		
0205CTCSTG2	6		20	20	1220.3	1207.86	20		
0205CTCSTG2	7		10	10	1211.93	1203.2	10		
0205CTCSTG2	8		10	10	1214.99	1207.49	10		
0205CTCSTG3	1		10	10	1219.96	1210	10		
0205CTCSTG3	2		10	9	1226.36	1218.24	9		
0205CTCSTG3	3		10	8	1210.76	1203.53	8		
0205CTCSTG3	4		10	10	1219.72	1209.31	10		
0205CTCSTG3	5		10	10	1234.35	1225.8	10		
0205CTCSTG3	6		10	10	1219	1209.12	10		
0205CTCSTG3	7		12	12	1220.98	1211.38	12		
0205CTCSTG3	8		10	10	1227.25	1218.38	10		

CETIS Test Summary

Report Date: 11 May-05 1:34 PM
Link: 12-2945-4726/Round 2

Chironomus 10-d Survival and Growth Sediment Test — U.S. EPA Region I Lab

Test No:	15-6316-9827	Test Type:	Survival-AF Growth	Duration:	N/A
Start Date:	14 Mar-05	Protocol:	EPA/600/R-99/064 (2000)	Species:	Chironomus tentans
Ending Date:		Dil Water:	None	Source:	In-House Culture
Setup Date:	14 Mar-05	Brine:			

Comments: Fort Devens Sediment Toxicity Test Round 2

Sample No:	07-4890-1125	Material:	Reference sediment	Client:	EPA REGION 1
Sample Date:	02 Feb-05 02:10 PM	Code:	0205CTCSTF1	Project:	Fort Devens Sediment Toxicity Test
Receive Date:		Source:	Fort Devens Flannagan SD		
Sample Age:	39d 9h	Station:	F1		

Comments: Fort Devens Sediment Toxicity Test

Sample No:	10-8278-2144	Material:	Site Sediment Sample	Client:	EPA REGION 1
Sample Date:	02 Feb-05 11:30 AM	Code:	0205CTCSTG1	Project:	Fort Devens Sediment Toxicity Test
Receive Date:		Source:	Fort Devens Grove SD		
Sample Age:	39d 12h	Station:	G1		

Comments: Fort Devens Sediment Toxicity Test

Sample No:	04-0345-2456	Material:	Site Sediment Sample	Client:	EPA REGION 1
Sample Date:	02 Feb-05 12:03 PM	Code:	0205CTCSTG2	Project:	Fort Devens Sediment Toxicity Test
Receive Date:		Source:	Fort Devens Grove SD		
Sample Age:	39d 11h	Station:	G2		

Comments: Fort Devens Sediment Toxicity Test

Sample No:	12-2847-5938	Material:	Site Sediment Sample	Client:	EPA REGION 1
Sample Date:	02 Feb-05 12:40 PM	Code:	0205CTCSTG3	Project:	Fort Devens Sediment Toxicity Test
Receive Date:		Source:	Fort Devens Grove SD		
Sample Age:	39d 11h	Station:	G3		

Comments: Fort Devens Sediment Toxicity Test

Sample No:	04-1029-3942	Material:	LAB ARTIFICIAL SEDIMENT	Client:	EPA REGION 1
Sample Date:	07 Feb-05	Code:	0205CTCSTLC2	Project:	Fort Devens Sediment Toxicity Test
Receive Date:		Source:	Fort Devens LC SD 2		
Sample Age:	35d 0h	Station:	LC2		

Comments: Fort Devens Sediment Toxicity Test Round 2

Sample No:	06-6005-0150	Material:	Site Sediment Sample	Client:	EPA REGION 1
Sample Date:	01 Feb-05 12:00 PM	Code:	0205CTCSTPS10	Project:	Fort Devens Sediment Toxicity Test
Receive Date:		Source:	Fort Devens Plow Shop SD		
Sample Age:	40d 12h	Station:	PS10		

Comments: Fort Devens Sediment Toxicity Test

Sample No:	09-2820-2109	Material:	Site Sediment Sample	Client:	EPA REGION 1
Sample Date:	01 Feb-05 03:00 PM	Code:	0205CTCSTPS11	Project:	Fort Devens Sediment Toxicity Test
Receive Date:		Source:	Fort Devens Plow Shop SD		
Sample Age:	40d 9h	Station:	PS11		

Comments: Fort Devens Sediment Toxicity Test

Sample No:	08-4418-3857	Material:	Site Sediment Sample	Client:	EPA REGION 1
Sample Date:	01 Feb-05 11:30 AM	Code:	0205CTCSTPS8	Project:	Fort Devens Sediment Toxicity Test
Receive Date:		Source:	Fort Devens Plow Shop SD		
Sample Age:	40d 12h	Station:	PS8		

Comments: Fort Devens Sediment Toxicity Test

CETIS Test Summary

Report Date: 11 May-05 1:34 PM
Link: 12-2945-4726/Round 2

Sample No:	11-9199-4343	**Material:**	Site Sediment Sample	**Client:**	EPA REGION 1
Sample Date:	01 Feb-05 11:20 AM	**Code:**	0205CTCSTPS9	**Project:**	Fort Devens Sediment Toxicity Test
Receive Date:		**Source:**	Fort Devens Plow Shop SD		
Sample Age:	40d 12h	**Station:**	PS9		

Comments: Fort Devens Sediment Toxicity Test

Mean AF Biomass-mg Summary

Sample Code	Reps	Mean	Minimum	Maximum	SE	SD	CV
0205CTCSTLC2	8	0.92988	0.79301	1.19199	0.04543	0.12850	13.82%
0205CTCSTF1	8	0.94975	0.78600	1.13000	0.03747	0.10600	11.16%
0205CTCSTPS8	8	0.83438	0.70000	0.96700	0.02906	0.08219	9.85%
0205CTCSTPS9	8	0.08237	0.02000	0.15299	0.01801	0.05095	61.85%
0205CTCSTPS10	8	0.97510	0.78199	1.17999	0.05340	0.15103	15.49%
0205CTCSTPS11	8	1.00338	0.80200	1.18800	0.04757	0.13456	13.41%
0205CTCSTG1	8	0.92800	0.77300	1.15400	0.05566	0.15743	16.96%
0205CTCSTG2	8	0.81013	0.62200	0.91700	0.03329	0.09416	11.62%
0205CTCSTG3	8	0.88775	0.72300	1.04099	0.03939	0.11142	12.55%

Proportion Survived Summary

Sample Code	Reps	Mean	Minimum	Maximum	SE	SD	CV
0205CTCSTLC2	8	0.85000	0.70000	1.00000	0.03780	0.10690	12.58%
0205CTCSTF1	8	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
0205CTCSTPS8	8	0.91250	0.80000	1.00000	0.02950	0.08345	9.15%
0205CTCSTPS9	8	0.45000	0.20000	0.80000	0.07792	0.22039	48.98%
0205CTCSTPS10	8	0.95000	0.80000	1.00000	0.02673	0.07559	7.96%
0205CTCSTPS11	8	0.90000	0.80000	1.00000	0.03273	0.09258	10.29%
0205CTCSTG1	8	0.92500	0.80000	1.00000	0.02500	0.07071	7.64%
0205CTCSTG2	8	0.98750	0.90000	1.00000	0.01250	0.03536	3.58%
0205CTCSTG3	8	0.96250	0.80000	1.00000	0.02631	0.07440	7.73%

Mean AF Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0205CTCSTLC2	0.79301	1.19199	0.96901	0.90299	0.80500	0.92200	0.99900	0.85601
0205CTCSTF1	0.89301	0.95701	1.04500	0.88400	0.91500	0.78600	0.98800	1.13000
0205CTCSTPS8	0.96700	0.81600	0.85699	0.70000	0.84199	0.75300	0.89800	0.84200
0205CTCSTPS9	0.04401	0.07100	0.15299	0.02000	0.03401	0.11901	0.14500	0.07300
0205CTCSTPS10	0.81399	0.95500	0.96499	0.86600	1.13301	1.10583	0.78199	1.17999
0205CTCSTPS11	0.80200	1.01300	0.84900	1.06901	1.18800	0.96300	0.99100	1.15199
0205CTCSTG1	0.77300	0.83101	0.81500	1.04900	1.15400	0.80701	0.86100	1.13400
0205CTCSTG2	0.77900	0.83800	0.88700	0.81500	0.91700	0.62200	0.87301	0.75000
0205CTCSTG3	0.99600	0.81200	0.72300	1.04099	0.85499	0.98800	0.80000	0.88700

Proportion Survived Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
0205CTCSTLC2	0.80000	1.00000	0.90000	0.90000	0.70000	0.70000	0.90000	0.90000
0205CTCSTF1	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
0205CTCSTPS8	1.00000	1.00000	0.90000	1.00000	0.80000	0.80000	0.90000	0.90000
0205CTCSTPS9	0.30000	0.40000	0.60000	0.20000	0.30000	0.80000	0.70000	0.30000
0205CTCSTPS10	1.00000	0.90000	1.00000	0.80000	1.00000	1.00000	0.90000	1.00000
0205CTCSTPS11	1.00000	0.80000	0.80000	0.90000	1.00000	0.90000	1.00000	0.80000
0205CTCSTG1	0.80000	1.00000	0.90000	0.90000	1.00000	1.00000	0.90000	0.90000
0205CTCSTG2	1.00000	1.00000	1.00000	1.00000	0.90000	1.00000	1.00000	1.00000
0205CTCSTG3	1.00000	0.90000	0.80000	1.00000	1.00000	1.00000	1.00000	1.00000

CETIS Analysis Detail

Chironomus 10-d Survival and Growth Sediment Test — **U.S. EPA Region I Lab**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	12-2945-4726	12-2945-4726	28 Mar-05 10:57 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Steel's Many-One Rank	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Bartlett	217.30020	20.09024	0.00000	Unequal Variances
Distribution	Kolmogorov-Smirnov D	0.09950	0.12177	0.07446	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	2.711926	0.3389907	8	19.71	0.00000	Significant Effect
Error	1.083336	0.0171958	63			
Total	3.79526138	0.3561865	71			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
0205CTCSTLC2		0205CTCSTF1	96	45	> 0.0500	3	Non-Significant Effect
0205CTCSTLC2		0205CTCSTPS8	78.5	45	> 0.0500	4	Non-Significant Effect
0205CTCSTLC2		0205CTCSTPS9	39.5	45	<= 0.0500	4	Significant Effect
0205CTCSTLC2		0205CTCSTPS1	86.5	45	> 0.0500	4	Non-Significant Effect
0205CTCSTLC2		0205CTCSTPS1	76	45	> 0.0500	4	Non-Significant Effect
0205CTCSTLC2		0205CTCSTG1	81	45	> 0.0500	4	Non-Significant Effect
0205CTCSTLC2		0205CTCSTG2	94	45	> 0.0500	3	Non-Significant Effect
0205CTCSTLC2		0205CTCSTG3	89	45	> 0.0500	4	Non-Significant Effect

Data Summary

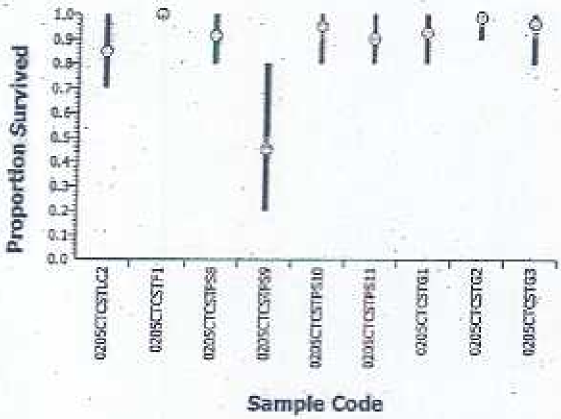
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
0205CTCSTLC2	8	0.85000	0.70000	1.00000	0.10690	1.18721	0.99116	1.41202	0.14595
0205CTCSTF1	8	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00025
0205CTCSTPS8	8	0.91250	0.80000	1.00000	0.08345	1.27469	1.10715	1.41202	0.12800
0205CTCSTPS9	8	0.45000	0.20000	0.80000	0.22039	0.73396	0.46365	1.10715	0.23161
0205CTCSTPS10	8	0.95000	0.80000	1.00000	0.07559	1.33491	1.10715	1.42595	0.11874
0205CTCSTPS11	8	0.90000	0.80000	1.00000	0.09258	1.25695	1.10715	1.41202	0.14121
0205CTCSTG1	8	0.92500	0.80000	1.00000	0.07071	1.29242	1.10715	1.41202	0.11004
0205CTCSTG2	8	0.98750	0.90000	1.00000	0.03536	1.39749	1.24905	1.45876	0.06217
0205CTCSTG3	8	0.96250	0.80000	1.00000	0.07440	1.35528	1.10715	1.42595	0.11585

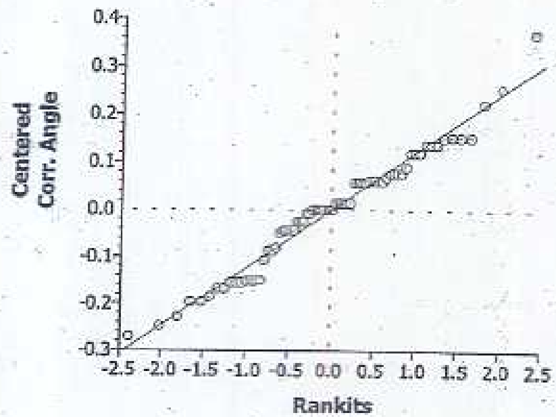
Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0205CTCSTLC2	0.80000	1.00000	0.90000	0.90000	0.70000	0.70000	0.90000	0.90000		
0205CTCSTF1	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000		
0205CTCSTPS8	1.00000	1.00000	0.90000	1.00000	0.80000	0.80000	0.90000	0.90000		
0205CTCSTPS9	0.30000	0.40000	0.60000	0.20000	0.30000	0.80000	0.70000	0.30000		
0205CTCSTPS10	1.00000	0.90000	1.00000	0.80000	1.00000	1.00000	0.90000	1.00000		
0205CTCSTPS11	1.00000	0.80000	0.80000	0.90000	1.00000	0.90000	1.00000	0.80000		
0205CTCSTG1	0.80000	1.00000	0.90000	0.90000	1.00000	1.00000	0.90000	0.90000		
0205CTCSTG2	1.00000	1.00000	1.00000	1.00000	0.90000	1.00000	1.00000	1.00000		
0205CTCSTG3	1.00000	0.90000	0.80000	1.00000	1.00000	1.00000	1.00000	1.00000		

CETIS Analysis Detail

Graphics





CETIS Analysis Detail

Comparisons:
Report Date: 25 Apr-05 1:35 PM
Analysis: 12-6107-4784/Round 2

Chironomus 10-d Survival and Growth Sediment Test

U.S. EPA Region I Lab

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	12-2945-4726	12-2945-4726	28 Mar-05 10:57 AM	CETISv1.025

Method	Alt H	Data Transform	Z
Steel's Many-One Rank	C > T	Angular (Corrected)	

NOEL	LOEL	Toxic Units	ChV	MSDp
		N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Bartlett	216.97580	18.47531	0.00000	Unequal Variances
Distribution	Kolmogorov-Smirnov D	0.09913	0.12896	0.11661	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	2.677076	0.3824394	7	22.92	0.00000	Significant Effect
Error	0.9342195	0.0166825	56			
Total	3.61129540	0.3991219	63			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
0205CTCSTF1		0205CTCSTPS8	48	45	> 0.0500	3	Non-Significant Effect
0205CTCSTF1		0205CTCSTPS9	36	45	<= 0.0500	2	Significant Effect
0205CTCSTF1		0205CTCSTPS1	60	45	> 0.0500	2	Non-Significant Effect
0205CTCSTF1		0205CTCSTPS1	48	45	> 0.0500	3	Non-Significant Effect
0205CTCSTF1		0205CTCSTG1	48	45	> 0.0500	2	Non-Significant Effect
0205CTCSTF1		0205CTCSTG2	68	45	> 0.0500	1	Non-Significant Effect
0205CTCSTF1		0205CTCSTG3	64	45	> 0.0500	1	Non-Significant Effect

Data Summary

Sample Code	Count	Original Data				Transformed Data			
		Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
0205CTCSTF1	8	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00025
0205CTCSTPS8	8	0.91250	0.80000	1.00000	0.08345	1.27469	1.10715	1.41202	0.12800
0205CTCSTPS9	8	0.45000	0.20000	0.80000	0.22039	0.73396	0.46365	1.10715	0.23161
0205CTCSTPS10	8	0.95000	0.80000	1.00000	0.07559	1.33491	1.10715	1.42595	0.11874
0205CTCSTPS11	8	0.90000	0.80000	1.00000	0.09258	1.25695	1.10715	1.41202	0.14121
0205CTCSTG1	8	0.92500	0.80000	1.00000	0.07071	1.29242	1.10715	1.41202	0.11004
0205CTCSTG2	8	0.98750	0.90000	1.00000	0.03536	1.39749	1.24905	1.45876	0.06217
0205CTCSTG3	8	0.96250	0.80000	1.00000	0.07440	1.35528	1.10715	1.42595	0.11585

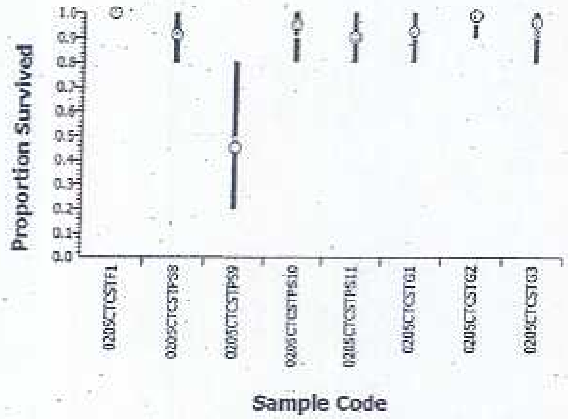
Data Detail

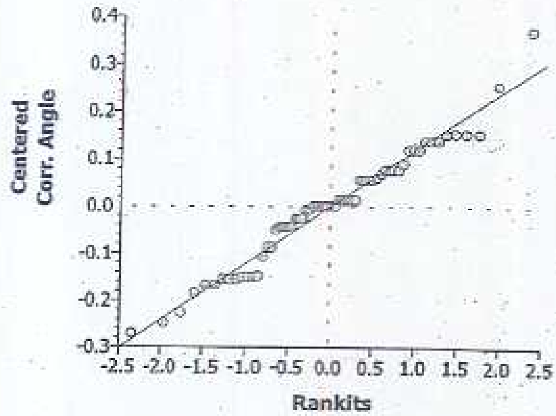
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0205CTCSTF1	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000		
0205CTCSTPS8	1.00000	1.00000	0.90000	1.00000	0.80000	0.80000	0.90000	0.90000		
0205CTCSTPS9	0.30000	0.40000	0.60000	0.20000	0.30000	0.80000	0.70000	0.30000		
0205CTCSTPS10	1.00000	0.90000	1.00000	0.80000	1.00000	1.00000	0.90000	1.00000		
0205CTCSTPS11	1.00000	0.80000	0.80000	0.90000	1.00000	0.90000	1.00000	0.80000		
0205CTCSTG1	0.80000	1.00000	0.90000	0.90000	1.00000	1.00000	0.90000	0.90000		
0205CTCSTG2	1.00000	1.00000	1.00000	1.00000	0.90000	1.00000	1.00000	1.00000		
0205CTCSTG3	1.00000	0.90000	0.80000	1.00000	1.00000	1.00000	1.00000	1.00000		

Analyst:________ Approval:________

CETIS Analysis Detail

Graphics





CETIS Analysis Detail

Chironomus 10-d Survival and Growth Sediment Test — U.S. EPA Region I Lab

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean AF Biomass-mg	Comparison	12-2945-4726	12-2945-4726	04 May-05 11:55 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Dunnett's Multiple Comparison	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Bartlett	10.57847	20.09024	0.22675	Equal Variances
Distribution	Kolmogorov-Smirnov D	0.07644	0.12177	0.34386	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	5.177542	0.6471927	8	46.94	0.00000	Significant Effect
Error	0.8685305	0.0137862	63			
Total	6.04607219	0.6609789	71			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
0205CTCSTLC2		0205CTCSTF1	-0.3386	2.43714	>0.0500	0.14308	Non-Significant Effect
0205CTCSTLC2		0205CTCSTPS8	1.62672	2.43714	>0.0500	0.14308	Non-Significant Effect
0205CTCSTLC2		0205CTCSTPS9	14.4360	2.43714	<=0.0500	0.14308	Significant Effect
0205CTCSTLC2		0205CTCSTPS1	-0.7704	2.43714	>0.0500	0.14308	Non-Significant Effect
0205CTCSTLC2		0205CTCSTPS1	-1.252	2.43714	>0.0500	0.14308	Non-Significant Effect
0205CTCSTLC2		0205CTCSTG1	0.03192	2.43714	>0.0500	0.14308	Non-Significant Effect
0205CTCSTLC2		0205CTCSTG2	2.03973	2.43714	>0.0500	0.14308	Non-Significant Effect
0205CTCSTLC2		0205CTCSTG3	0.7176	2.43714	>0.0500	0.14308	Non-Significant Effect

Data Summary

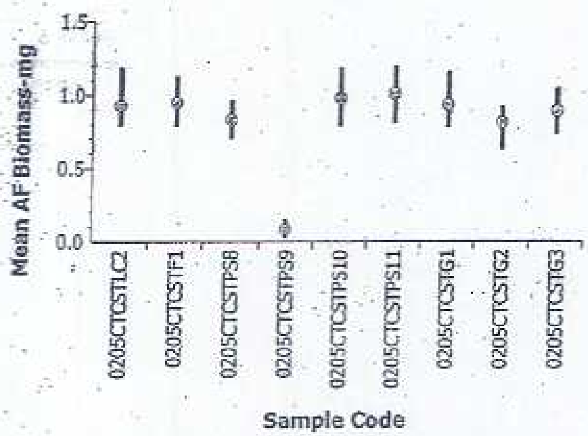
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
0205CTCSTLC2	8	0.92988	0.79301	1.19199	0.12850				
0205CTCSTF1	8	0.94975	0.78600	1.13000	0.10599				
0205CTCSTPS8	8	0.83438	0.70000	0.96700	0.08219				
0205CTCSTPS9	8	0.08237	0.02000	0.15299	0.05095				
0205CTCSTPS10	8	0.97510	0.78199	1.17999	0.15103				
0205CTCSTPS11	8	1.00338	0.80200	1.18800	0.13456				
0205CTCSTG1	8	0.92800	0.77300	1.15400	0.15743				
0205CTCSTG2	8	0.81013	0.62200	0.91700	0.09416				
0205CTCSTG3	8	0.88775	0.72300	1.04099	0.11142				

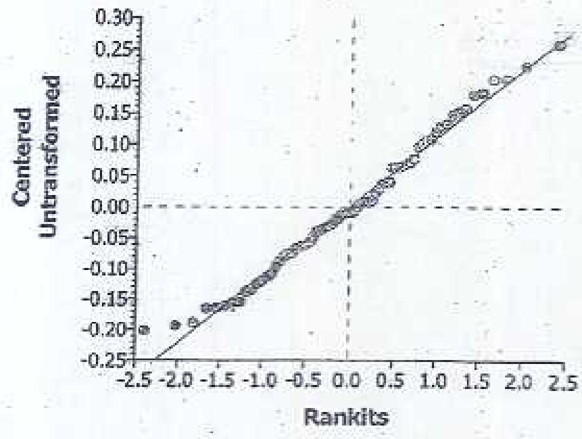
Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0205CTCSTLC2	0.79301	1.19199	0.96901	0.90299	0.80500	0.92200	0.99900	0.85601		
0205CTCSTF1	0.89301	0.95701	1.04500	0.88400	0.91500	0.78600	0.98800	1.13000		
0205CTCSTPS8	0.96700	0.81600	0.85699	0.70000	0.84199	0.75300	0.89800	0.84200		
0205CTCSTPS9	0.04401	0.07100	0.15299	0.02000	0.03401	0.11901	0.14500	0.07300		
0205CTCSTPS10	0.81399	0.95500	0.96499	0.86600	1.13301	1.10583	0.78199	1.17999		
0205CTCSTPS11	0.80200	1.01300	0.84900	1.06901	1.18800	0.96300	0.99100	1.15199		
0205CTCSTG1	0.77300	0.83101	0.81500	1.04900	1.15400	0.80701	0.86100	1.13400		
0205CTCSTG2	0.77900	0.83800	0.88700	0.81500	0.91700	0.62200	0.87301	0.75000		
0205CTCSTG3	0.99600	0.81200	0.72300	1.04099	0.85499	0.98800	0.80000	0.88700		

CETIS Analysis Detail

Graphics





CETIS Analysis Detail

Chironomus 10-d Survival and Growth Sediment Test U.S. EPA Region I Lab

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean AF Biomass-mg	Comparison	12-2945-4726	12-2945-4726	04 May-05 11:55 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Dunnett's Multiple Comparison	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Bartlett	10.44041	18.47531	0.16496	Equal Variances
Distribution	Kolmogorov-Smirnov D	0.07430	0.12896	0.47707	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	5.073396	0.7247709	7	53.90	0.00000	Significant Effect
Error	0.7529483	0.0134455	56			
Total	5.82634449	0.7382164	63			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
0205CTCSTF1		0205CTCSTPS8	1.99002	2.39429	> 0.0500	0.13881	Non-Significant Effect
0205CTCSTF1		0205CTCSTPS9	14.9606	2.39429	<= 0.0500	0.13881	Significant Effect
0205CTCSTF1		0205CTCSTPS1	-0.4373	2.39429	> 0.0500	0.13881	Non-Significant Effect
0205CTCSTF1		0205CTCSTPS1	-0.9249	2.39429	> 0.0500	0.13881	Non-Significant Effect
0205CTCSTF1		0205CTCSTG1	0.37514	2.39429	> 0.0500	0.13881	Non-Significant Effect
0205CTCSTF1		0205CTCSTG2	2.40824	2.39429	<= 0.0500	0.13881	Significant Effect
0205CTCSTF1		0205CTCSTG3	1.06946	2.39429	> 0.0500	0.13881	Non-Significant Effect

Data Summary

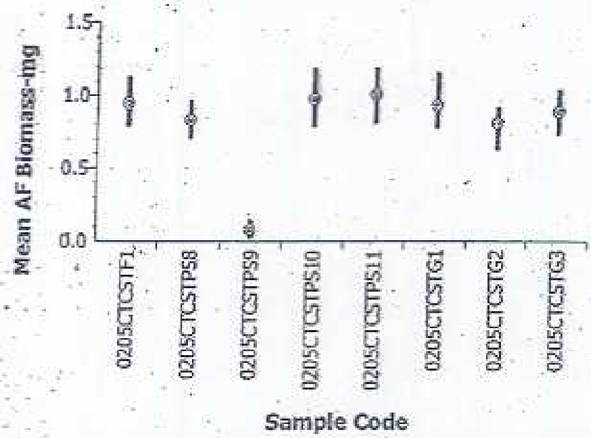
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
0205CTCSTF1	8	0.94975	0.78600	1.13000	0.10599				
0205CTCSTPS8	8	0.83438	0.70000	0.96700	0.08219				
0205CTCSTPS9	8	0.08237	0.02000	0.15299	0.05095				
0205CTCSTPS10	8	0.97510	0.78199	1.17999	0.15103				
0205CTCSTPS11	8	1.00338	0.80200	1.18800	0.13456				
0205CTCSTG1	8	0.92800	0.77300	1.15400	0.15743				
0205CTCSTG2	8	0.81013	0.62200	0.91700	0.09416				
0205CTCSTG3	8	0.88775	0.72300	1.04099	0.11142				

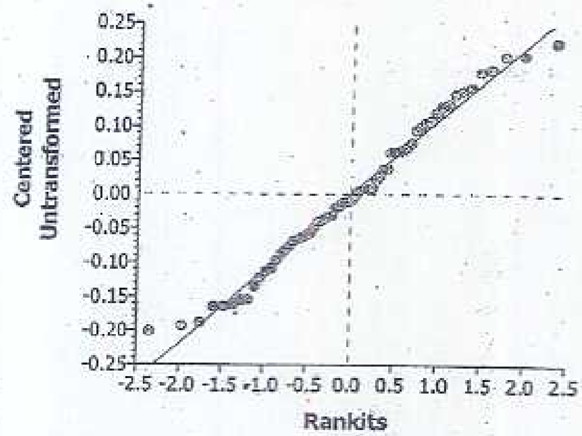
Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0205CTCSTF1	0.89301	0.95701	1.04500	0.88400	0.91500	0.78600	0.98800	1.13000		
0205CTCSTPS8	0.96700	0.81600	0.85699	0.70000	0.84199	0.75300	0.89800	0.84200		
0205CTCSTPS9	0.04401	0.07100	0.15299	0.02000	0.03401	0.11901	0.14500	0.07300		
0205CTCSTPS10	0.81399	0.95500	0.96499	0.86600	1.13301	1.10583	0.78199	1.17999		
0205CTCSTPS11	0.80200	1.01300	0.84900	1.06901	1.18800	0.96300	0.99100	1.15199		
0205CTCSTG1	0.77300	0.83101	0.81500	1.04900	1.15400	0.80701	0.86100	1.13400		
0205CTCSTG2	0.77900	0.83800	0.88700	0.81500	0.91700	0.62200	0.87301	0.75000		
0205CTCSTG3	0.99600	0.81200	0.72300	1.04099	0.85499	0.98800	0.80000	0.88700		

CETIS Analysis Detail

Graphics





Appendix E

Control Charts for *H. azteca* and *C. tentans*

Appendix E
Risk Apportionment for Wildlife Receptors

TABLE E-1
Apportionment of Risk $_{MAX}$ Grove Pond Raccoon

	Uptake (mg/kg-d) [a]								HQ		Risk Apportionment (% of COPC uptake for each dietary item) [b]						
Chemical	Sediment	Surface Water	Fish	Invertebrates	Frog	Swallow Eggs	Plants	Total Uptake	NOAEL	LOAEL	Sediment	Surface Water	Fish	Invertebrates	Frog	Swallow Eggs	Plants
aluminum	2042.86	0.01	1.04	1.51	5.45	1.51	1.20	2053.59	**1064**	**106**	**99**	0.00	0.05	0.07	0.27	0.07	0.06
Antimony	0.27	0.00	0.00	0.55	0.55	0.55	0.01	1.93	**15**	**2**	14	0.00	0.00	**28**	**28**	**28**	0.42
arsenic	20.66	0.01	0.01	0.09	0.02	0.05	0.11	20.94	**166**	**17**	**99**	0.05	0.03	0.41	0.12	0.23	0.52
barium	10.67	0.00	0.19	1.89	0.69	1.89	0.23	15.56	**3.05**	**1.02**	**69**	0.01	1.19	12.15	4.44	12.15	1.51
Beryllium	0.32	0.00	0.05	0.64	0.00	0.64	0.00	1.65	**2.50**	0.83	19	0.00	3.02	**39**	0.00	**39**	0.03
cadmium	16.57	0.00	0.05	0.05	0.01	0.03	0.88	17.60	**18**	**6**	**94**	0.00	0.29	0.31	0.08	0.15	5.03
Cobalt	1.59	0.00	0.00	3.53	3.53	3.53	0.23	12.41	**1.69**	0.66	13	0.00	0.00	**28**	**28**	**28**	1.88
copper	295.08	0.00	0.07	1.28	2.99	1.28	17.31	318.01	**27**	**21**	**93**	0.00	0.02	0.40	0.94	0.40	5.44
lead	39.95	0.00	0.25	0.04	0.14	0.02	0.26	40.67	**5.08**	0.51	**98**	0.01	0.62	0.11	0.33	0.06	0.65
manganese	56.75	0.09	2.72	39.60	3.55	39.60	8.32	150.62	**1.71**	0.53	**38**	0.06	1.81	**26**	2.35	**26**	5.53
Methylmercury	0.00	0.00	0.05	0.00	0.01	0.00	0.00	0.07	**2.29**	0.46	2.18	0.00	**75**	3.16	17	3.16	0.04
selenium	0.94	0.00	0.03	0.00	0.03	0.00	0.00	1.00	**4.99**	**3**	**94**	0.00	2.80	0.00	3.26	0.00	0.22
Thallium	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.03	**4.3**	0.43	14	0.00	0.00	**29**	**29**	**29**	0.01
vanadium	3.18	0.00	0.05	7.06	0.02	7.06	0.47	17.83	**84.9**	**8**	18	0.00	0.26	**40**	0.09	**40**	2.61
PAH (Total)	0.95	0.00	0.00	2.63	2.63	2.63	0.00	8.84	**8.84**	0.88	11	0.00	0.00	**30**	**30**	**30**	0.03

a. Calculated using EPC and exposure parameters in Table 37.
b. Risk % calculated by 100*Uptake/Total Uptake, for each dietary component "I".

TABLE E-2
Apportionment of Risk Average
Grove Pond Raccoon

Chemical	Uptake (mg/kg-d)[a]								HQ		Risk Apportionment (% of COPC uptake for each dietary item)[b]						
	Sediment	Surface Water	Fish	Invertebrates	Frog	Swallow Eggs	Plants	Total Uptake	NOAEL	LOAEL	Sediment	Surface Water	Fish	Invertebrates	Frog	Swallow Eggs	Plants
Inorganics																	
aluminum	242.34	0.00	0.31	1.35	1.11	1.35	0.14	246.59	128	13	98	0.00	0.12	0.55	0.45	0.55	0.06
Antimony	0.25	0.00	0.00	0.50	0.50	0.50	0.01	1.76	14	1.4	14	0.00	0.00	28	28	28	0.42
arsenic	1.79	0.00	0.01	0.04	0.01	0.01	0.01	1.87	15	1.5	96	0.06	0.53	2.31	0.39	0.67	0.50
barium	1.88	0.00	0.06	1.54	0.24	1.54	0.04	5.31	1.0	0.35	35	0.02	1.21	29	4.54	29	0.78
manganese	13.55	0.02	0.88	36.28	1.16	36.28	1.99	90.17	1.0	0.32	15	0.02	0.98	40	1.29	40	2.20
Methylmercury	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.04	1.4	0.28	1.09	0.00	22	2.89	9.07	65	0.02
selenium	0.17	0.00	0.02	0.00	0.01	0.00	0.00	0.20	1.0	0.61	85	0.00	8.51	0.00	6.18	0.00	0.20
Thallium	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.03	3.4	0.34	14	0.00	0	29	29	29	0.01
vanadium	0.74	0.00	0.01	1.64	0.01	1.64	0.11	4.13	20	2.0	18	0.00	0.14	40	0.31	40	2.61
SVOC																	
PAH (Total)	0.13	0.00	0.00	0.35	0.35	0.35	0.00	1.16	1.2	0.39	11	0.00	0.00	30	30	30	0.03

a. Calculated using EPC and exposure parameters in Table 38.
b. Risk % calculated by 100*Uptake/Total Uptake, for each dietary component "I".

TABLE E-3
Apportionment of Risk $_{Max}$ Plow Shop Pond Raccoon

	Uptake (mg/kg-d) [a]								HQ		Risk Apportionment (% of COPC uptake for each dietary item) [b]						
Chemical	Sediment	Surface Water	Fish	Invertebrates	Frog	Swallow Eggs	Plants	Total	NOAEL	LOAEL	Sediment	Surface Water	Fish	Invertebrates	Frog	Swallow Eggs	Plants
aluminum	612.86	0.02	0.23	0.15	16.65	0.15	0.36	630.40	**327**	**33**	**97**	0	0	0	3	0	0
Antimony	0.70	0.00	0.00	1.39	1.39	1.39	0.02	4.90	**39**	**4**	**14**	0	0	**28**	**28**	**28**	0
arsenic	154.35	0.03	0.07	0.12	0.04	0.03	0.81	155.45	**1274**	**127**	**99**	0	0	0	0	0	1
barium	8.40	0.00	0.22	4.80	0.99	4.80	0.18	19.40	**3.80**	**1.3**	**43**	0	1	**25**	5	**25**	1
cadmium	1.50	0.00	0.00	0.03	0.01	0.00	0.08	1.63	**1.63**	0.54	**92**	0	0	2	1	0	5
Cobalt	1.34	0.00	0.01	2.98	2.98	2.98	0.20	10.47	**1.43**	0.55	**13**	0	0	**28**	**28**	**28**	2
copper	78.31	0.00	0.07	1.23	0.27	1.23	4.59	85.70	**7.32**	**5.6**	**91**	0	0	1	0	1	5
lead	27.56	0.00	0.01	0.02	0.05	0.02	0.18	27.86	**3.48**	0.35	**99**	0	0	0	0	0	1
manganese	1243.87	0.05	4.78	52.56	2.40	52.56	182.43	1538.65	**17**	**5.4**	**81**	0	0	3	0	3	**12**
Methylmercury	0.00	0.00	0.13	0.00	0.01	0.05	0.00	0.20	**6.21**	**1.2**	1	0	**65**	1	6	**27**	0
selenium	0.33	0.00	0.03	0.01	0.04	0.01	0.00	0.43	**2.14**	**1.3**	**78**	0	8	2	9	2	0
Thallium	0.67	0.00	0.00	1.33	1.33	1.33	0.00	4.67	**632**	**63.2**	**14**	0	0	**29**	**29**	**29**	0
vanadium	3.77	0.00	0.04	8.37	0.03	8.37	0.55	21.14	**101**	**10.1**	**18**	0	0	**40**	0	**40**	3
PAH (Total)	2.24	0.00	0.00	6.17	6.17	6.17	0.01	20.76	**21**	**6.9**	**11**	0	0	**30**	**30**	**30**	0

a. Calculated using EPC and exposure parameters in Table 43.
b. Risk % calculated by 100*Uptake$_i$/Total Uptake, for each dietary component "I".

TABLE E-4
Apportionment of Risk Average **Plow Shop Pond Raccoon**

	Uptake (mg/kg-d) [a]								HQ		Risk Apportionment (% of COPC uptake for each dietary item) [b]						
Chemical	**Sediment (mg/kg)**	**Surface Water (mg/L)**	**Fish (mg/kg)**	**Invertebrates (mg/kg)**	**Frog (mg/kg)**	**Swallow Eggs (mg/kg)**	**Plants (mg/kg)**	**Total**	**NOAEL**	**LOAEL**	**Sediment**	**Surface Water**	**Fish**	**Invertebrates**	**Frog**	**Swallow Eggs**	**Plants**
aluminum	186.77	0.00	0.10	0.10	3.78	0.10	0.11	190.97	**99**	**9.9**	**98**	0.00	0.05	0.05	1.98	0.05	0.06
Antimony	0.35	0.00		0.71	0.71	0.71	0.01	2.48	**20**	**2.0**	14	0.00	0.00	**28**	**28**	**28**	0.42
arsenic	12.30	0.00	0.02	0.05	0.01	0.00	0.06	12.45	**101**	**10**	**99**	0.01	0.16	0.42	0.10	0.00	0.52
barium	2.29	0.00	0.08	3.15	0.37	3.15	0.05	9.08	**1.8**	0.59	**25**	0.01	0.86	**35**	4.02	**35**	0.55
manganese	53.29	0.01	1.52	33.91	0.85	33.91	7.82	131.30	**1.5**	0.46	**41**	0.01	1.16	**26**	0.64	**26**	5.95
Methylmercury	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.03	**1.09**	0.22	2.39	0.00	**85**	3.59	9.22	0	0.05
selenium	0.33	0.00	0.02	0.01	0.02	0.01	0.00	0.38	**1.9**	**1.2**	**85**	0.11	5.12	2.26	5.14	2.26	0.20
Thallium	0.53	0.00	0.00	1.06	1.06	1.06	0.00	3.71	**501**	**50**	14	0.01	0	**29**	**29**	**29**	0.01
vanadium	0.60	0.00	0.02	1.34	0.02	1.34	0.09	3.41	**16**	**1.6**	18	0.00	0.53	**39**	0.49	**39**	2.60
PAH (Total)	0.23	0.00	0.00	0.63	0.63	0.63	0.00	2.12	**2.1**	0.71	11	0.00	0.00	**30**	29.73	**30**	0.03

a. Calculated using EPC and exposure parameters in Table 44.
b. Risk % calculated by 100*Uptake/Total Uptake, for each dietary component "I".

TABLE E-5
Apportionment of Risk $_{Max}$ Grove Pond Mink

	Uptake (mg/kg-d) [a]				HQ		Risk Apportionment (% of COPC uptake for each dietary item) [b]		
Chemical	**Sediment**	**Surface Water**	**Fish**	**Total**	**NOAEL**	**LOAEL**	**Sediment**	**Surface Water**	**Fish**
aluminum	126.00	0.01	2.87	128.88	**66.78**	**6.68**	**98**	0.02	2.23
arsenic	1.27	0.01	0.02	1.30	**10.34**	**1.03**	**98**	0.10	1.42
cadmium	1.02	0.00	0.14	1.16	**1.16**	0.39	**88**	0.00	**12**
copper	18.20	0.00	0.19	18.39	**1.57**	**1.19**	**99**	0.16	1.02
Methylmercury	0.00	0.00	0.15	0.15	**4.71**	0.94	0	0.00	**100**
vanadium	0.20	0.00	0.13	0.32	**1.54**	0.15	**61**	0.00	**39**

a. Calculated using EPC and exposure parameters in Table 45.

b. Risk % calculated by 100*Uptake$_i$/Total Uptake, for each dietary component "I".

TABLE E-6
Apportionment of Risk Average Grove Pond Mink

	Uptake (mg/kg-d) a				HQ		Risk Apportionment (% of COPC uptake for each dietary item) [b]		
Chemical	**Sediment**	**Surface Water**	**Fish**	**Total**	**NOAEL**	**LOAEL**	**Sediment**	**Surface Water**	**Fish**
aluminum	14.95	0.00	0.84	15.79	**8.18**	0.82	**95**	0.04	5.31
arsenic	0.11	0.00	0.03	0.14	**1.10**	0.11	**79**	0.10	**20**

a. Calculated using EPC and exposure parameters in Table 46.
b. Risk % calculated by 100*$Uptake_i$/Total Uptake, for each dietary component "I".

TABLE E-7
Apportionment of Risk $_{Max}$ Plow Shop Pond Mink

	Uptake (mg/kg-d) a				HQ		Risk Apportionment (% of COPC uptake for each dietary item) [b]		
Chemical	**Sediment**	**Surface Water**	**Fish**	**Total**	**NOAEL**	**LOAEL**	**Sediment**	**Surface Water**	**Fish**
aluminum	38	0.02	0.62	38	**20**	**1.99**	**98**	0	2
arsenic	10	0.03	0	10	**189**	**18.91**	**98**	0	2
manganese	77	0.05	13	90	**1.02**	0.32	**85**	5	**15**
Methylmercury	0.00	0.00	0.36	0.36	**11.11**	**2.22**	0	0	**100**
Thallium	0.04	0.00	0.00	0.04	**5.78**	0.58	**96**	0	0
vanadium	0.23	0.00	0.11	0.34	**1.64**	0.16	**68**	0	**32**

a. Calculated using EPC and exposure parameters in Table 47.
b. Risk % calculated by 100*Uptake$_i$/Total Uptake, for each dietary component "I".

TABLE E-8
Apportionment of Risk Average Plow Shop Pond Mink

	Uptake (mg/kg-d) a				HQ		Risk Apportionment (% of COPC uptake for each dietary item) [b]		
Chemical	**Sediment**	**Surface Water**	**Fish**	**Total**	**NOAEL**	**LOAEL**	**Sediment**	**Surface Water**	**Fish**
aluminum	11.52	0.00	0.29	11.81	**6.12**	0.61	**98**	0.02	2.42
arsenic	0.76	0.00	0.04	0.80	**12.27**	**1.23**	**95**	0.01	**5**
Methylmercury	0.00	0.00	0.08	0.08	**2.54**	0.51	0	0.00	**100**
Thallium	0.03	0.00	0.00	0.03	**4.46**	0.45	**99**	0.01	0.00

a. Calculated using EPC and exposure parameters in Table 48.
b. Risk % calculated by 100*$Uptake_i$/Total Uptake, for each dietary component "I".

TABLE E-9
Apportionment of Risk $_{Max}$ Grove Pond Belted Kingfisher

Chemical	Uptake (mg/kg-d)[a] Surface Water	Fish	Total	HQ NOAEL	LOAEL	Risk Apportionment (% of COPC uptake for each dietary item)[b] Surface Water	Fish
lead	0.0030	2.48	2.48	**2.20**	0.22	1.20E-03	**100**
Methylmercury	0.0000	0.54	0.54	**83.79**	**8.38**	5.15E-08	**100**
DDT		0.06	0.06	**4.58**	0.46	0	**100**
DDE		0.13	0.13	**9.51**	0.95	0	**100**
Total PCB		0.23	0.23	**1.29**	0.13	0	**100**

a. Calculated using EPC and exposure parameters in Table 53.
b. Risk % calculated by 100*Uptake$_i$/Total Uptake, for each dietary component "I".

TABLE E-10
Apportionment of Risk Average Grove Pond Belted Kingfisher

	Uptake (mg/kg-d)		HQ		Risk Apportionment (% of COPC uptake for each dietary item)
Chemical	**Fish**	**Total**	**NOAEL**	**LOAEL**	**Fish**
Methylmercury	0.10	0.10	**15.11**	**1.51**	100
DDD	0.02	0.02	**1.40**	0.14	100
DDE	0.04	0.04	**3.13**	0.31	100

TABLE E-11
Apportionment of Risk $_{Max}$ Plow Shop Pond Belted Kingfisher

	Uptake (mg/kg-d)			HQ		Risk Apportionment (% of COPC uptake for each dietary item)$_b$	
Chemical	**Surface Water**	**Fish**	**Total**	**NOAEL**	**LOAEL**	**Surface Water**	**Fish**
arsenic	4.18E-02	6.41E-01	6.83E-01	1.30E-01	5.00E-02	6	**94**
Methylmercury		1.27E+00	1.27E+00	**1.98E+02**	**1.98E+01**		**100**
4,4'-DDD		5.43E-02	5.43E-02	**3.88E+00**	3.88E-01		**100**
4,4'-DDE		1.87E-01	1.87E-01	**1.34E+01**	**1.34E+00**		**100**

a. Calculated using EPC and exposure parameters in Table 55.

b. Risk % calculated by 100*Uptake$_i$/Total Uptake, for each dietary component "I".

Table E-12
Apportionment of Risk Average Plow Shop Pond Belted Kingfisher

	Uptake (mg/kg-d)		HQ		Risk Apportionment (% of COPC uptake for each dietary item)
Chemical	Fish	Total	NOAEL	LOAEL	Fish
Methylmercury	0.29	0.29	**45**	**4.5**	100
4,4'-DDE	0.04	0.04	**2.9**	0.3	100

TABLE E-13
Apportionment of Risk $_{Max}$ Grove Pond Black -Crowned Night Heron

	Uptake (mg/kg-d)[a]						HQ		Risk Apportionment (% of COPC uptake for each dietary item)[b]				
Chemical	Sediment	Surface Water	Fish	Invertebrates	Frog	Total	NOAEL	LOAEL	Sediment	Surface Water	Fish	Invertebrates	Frog
aluminum	478.64	0.01	1.82	2.63	9.48	492.57	**4.5**	**1.5**	**97**	0.00	0.37	1	2
Antimony	0.06	0.00	0.00	0.96	0.96	1.98	**16**	**1.6**	3.26	0.00	0.00	**48**	**48**
Beryllium	0.07	0.00	0.09	1.11	0.00	1.28	**1.9**	0.64	5.88	0.00	6.80	**87**	0
cadmium	3.88	0.00	0.09	0.09	0.02	4.09	**2.8**	0.20	**95**	0.00	2.20	2	1
chromium	276.55	0.01	0.16	0.31	1.00	278.02	**278**	**56**	**99**	0.00	0.06	0	0
Cobalt	0.37	0.00	0.00	6.14	6.14	12.66	**1.7**	0.69	2.94	0.00	0.00	**49**	**49**
copper	69.14	0.00	0.12	2.23	5.19	76.68	**1.6**	**1.2**	**90**	0.00	0.15	3	7
lead	9.36	0.00	0.44	0.08	0.24	10.12	**9.0**	0.90	**93**	0.01	4.36	1	2
Mercury (inorganic)	2.24	0.00	0.01	0.00	0.02	2.27	**5.1**	**2.5**	**99**	0.00	0.22	0	1
Methylmercury	0.00	0.00	0.10	0.00	0.02	0.12	**19**	**1.9**	0.31	0.00	**79**	3	**18**
Thallium	0.00	0.00	0.00	0.02	0.02	0.03	**4.4**	0.44	3.26	0.00	0.00	**48**	**48**
vanadium	0.74	0.00	0.08	12.29	0.03	13.14	**1.2**	0.38	5.67	0.00	0.62	**94**	0
DDD	0.01	0.00	0.01	0.21	0.21	0.44	**32**	**3.2**	3.01	0.00	2.58	**47**	**47**
DDE	0.01	0.00	0.02	0.08	0.08	0.19	**14**	**1.4**	2.71	0.00	**12**	**42**	**42**
DDT	0.02	0.00	0.00	0.28	0.28	0.57	**41**	**4.1**	3.09	0.00	0.00	**48**	**48**

a. Calculated using EPC and exposure parameters in Table 49.

b. Risk % calculated by 100*Uptake$_i$/Total Uptake, for each dietary component "I".

TABLE E-14
Apportionment of Risk Average Grove Pond Black -Crowned Night Heron

	Uptake (mg/kg-d)[a]						HQ		Risk Apportionment (% of COPC uptake for each dietary item) [b]				
Chemical	**Sediment**	**Surface Water**	**Fish**	**Invertebrates**	**Frog**	**Total**	**NOAEL**	**LOAEL**	**Sediment**	**Surface Water**	**Fish**	**Invertebrates**	**Frog**
Antimony	0.06	0.00	0.00	0.87	0.87	1.80	**14**	**1.4**	3.26	0.00	0.00	**48**	**48**
chromium	31.16	0.00	0.06	0.11	0.10	31.43	**31**	**6.3**	**99**	0.00	0.19	0.35	0.33
lead	1.40	0.00	0.06	0.03	0.04	1.53	**1.4**	0.14	**91**	0.02	4.09	2.00	2.90
Methylmercury	0.00	0.00	0.02	0.00	0.01	0.03	**4.2**	0.42	0.43	0.00	**65**	8.43	**27**
Thallium	0.00	0.00	0.00	0.01	0.01	0.03	**3.5**	0.35	3.26	0.00	0.00	**48**	**48**
DDD	0.00	0.00	0.00	0.03	0.03	0.06	**4.2**	0.42	2.91	0.00	5.95	**46**	**46**
DDE	0.00	0.00	0.01	0.01	0.01	0.029	**2.1**	0.21	2.25	0.00	**27**	**35**	**35**
DDT	0.00	0.00	0.00	0.01	0.01	0.016	**1.1**	0.11	3.09	0.00	0.00	**48**	**48**

a. Calculated using EPC and exposure parameters in Table 50.
b. Risk % calculated by 100*Uptake$_i$/Total Uptake, for each dietary component "I".

TABLE E-15
Apportionment of Risk $_{Max}$ Plow Shop Pond Black-Crowned Night Heron

	Uptake (mg/kg-d)[a]						HQ		Risk Apportionment (% of COPC uptake for each dietary item)[b]				
Chemical	**Sediment**	**Surface Water**	**Fish**	**Invertebrates**	**Frog**	**Total**	**NOAEL**	**LOAEL**	**Sediment**	**Surface Water**	**Fish**	**Invertebrates**	**Frog**
aluminum	1.44E+02	1.01E-02	3.95E-01	2.58E-01	2.90E+01	1.73E+02	**1.6**	0.53	**83**	0	0	0	**17**
Antimony	1.63E-01	2.25E-04	0.00E+00	2.42E+00	2.42E+00	5.01E+00	**40**	**4.0**	3	0	0	**48**	**48**
arsenic	3.62E+01	1.71E-02	1.14E-01	2.15E-01	6.19E-02	3.66E+01	**8.9**	**3.6**	**99**	0	0	1	0
chromium	2.01E+02	1.35E-04	8.69E-02	2.80E-01	9.48E-01	2.02E+02	**202**	**40**	**99**	0	0	0	0
Cobalt	3.14E-01	5.85E-04	1.49E-02	5.18E+00	5.18E+00	1.07E+01	**1.4**	0.58	3	0	0	**48**	**48**
lead	6.46E+00	2.25E-04	1.58E-02	4.12E-02	9.56E-02	6.61E+00	**5.9**	0.59	**98**	0	0	1	1
Mercury (inorganic)	1.33E+00	0.00E+00	1.18E-02	6.05E-03	1.76E-02	1.37E+00	**3.0**	**1.5**	**97**	0	1	0	1
Methylmercury	4.36E-04	0.00E+00	2.25E-01	4.91E-03	1.97E-02	2.50E-01	**39**	**3.9**	0	0	**90**	2	8
Thallium	1.56E-01	9.00E-04	0.00E+00	2.32E+00	2.32E+00	4.80E+00	**649**	**65**	3	0	0	**48**	**48**
vanadium	8.83E-01	6.75E-05	7.02E-02	1.46E+01	6.08E-02	1.56E+01	**1.4**	0.46	6	0	0	**93**	0
4,4'-DDD	9.57E-03	0.00E+00	9.65E-03	1.50E-01	1.50E-01	3.19E-01	**23**	**2.3**	3	0	3	**47**	**47**
4,4'-DDE	6.91E-03	0.00E+00	3.33E-02	1.08E-01	1.08E-01	2.57E-01	**18**	**1.8**	3	0	**13**	**42**	**42**
4,4'-DDT	6.91E-04	0.00E+00	1.23E-03	1.08E-02	1.08E-02	2.36E-02	**1.7**	0.17	3	0	5	**46**	**46**

a. Calculated using EPC and exposure parameters in Table 51.

b. Risk % calculated by 100*Uptake$_i$/Total Uptake, for each dietary component "I".

TABLE E-16
Apportionment of Risk Average Plow Shop Pond Black- Crowed Night Heron

	Uptake (mg/kg-d)[a]						HQ		Risk Apportionment (% of COPC uptake for each dietary item)[b]				
Chemical	**Sediment**	**Surface Water**	**Fish**	**Invertebrates**	**Frog**	**Total**	**NOAEL**	**LOAEL**	**Sediment**	**Surface Water**	**Fish**	**Invertebrates**	**Frog**
Antimony	8.27E-02	6.54E-05		1.23E+00	1.23E+00	2.54E+00	**20**	**2.0**	3.26	0.00	0.00	**48**	**48**
chromium	1.21E+01	6.85E-05	4.72E-02	1.09E-01	1.45E-01	1.24E+01	**12**	**2.5**	**98**	0.00	0.38	0.88	1.17
Methylmercury	1.95E-04	0.00E+00	5.14E-02	2.18E-03	5.59E-03	5.94E-02	**9.3**	0.93	0.33	0.00	**87**	3.66	9.42
Thallium	1.24E-01	2.15E-04	0.00E+00	1.84E+00	1.84E+00	3.81E+00	**515**	**51**	3.26	0.01	0.00	**48**	**48**
4,4'-DDD	4.43E-04		1.75E-03	6.94E-03	6.94E-03	1.61E-02	**1.1**	0.11	2.75	0.00	**11**	**43**	**43**
4,4'-DDE	3.24E-04		7.20E-03	5.08E-03	5.08E-03	1.77E-02	**1.3**	0.13	1.83	0.00	**41**	**29**	**29**

a. Calculated using EPC and exposure parameters in Table 52.

b. Risk % calculated by 100*$Uptake_i$/Total Uptake, for each dietary component "I".

TABLE E-17
Apportionment of Risk $_{Max}$ Grove Pond Tree Swallow

	Uptake (mg/kg-d)		HQ		Risk Apportionment (% of COPC uptake for each dietary item)
Chemical	**Swallow stomach contents**	**Total**	**NOAEL**	**LOAEL**	**Swallow stomach contents**
Arsenic	6.87E+00	6.87E+00	**1.34**	0.55	100
Chromium	1.12E+03	1.12E+03	**1124**	**225**	100
Lead	5.43E+00	5.43E+00	**4.81**	0.48	100
Methylmercury	1.79E-01	1.79E-01	**28**	**2.79**	100

TABLE E-18
Apportionment of Risk Average Grove Pond Tree Swallow

	Uptake (mg/kg-d)		HQ		Risk Apportionment (% of COPC uptake for each dietary item)
Chemical	**Swallow stomach contents**	**Total**	**NOAEL**	**LOAEL**	**Swallow stomach contents**
Chromium	1.99E+02	1.99E+02	**199**	**40**	100
Lead	2.48E+00	2.48E+00	**2.2**	0.2	100
Methylmercury	1.30E-01	1.30E-01	**20**	**2.0**	100

TABLE E-19
Apportionment of Risk $_{Max}$ Plow Shop Pond Tree Swallow

	Uptake (mg/kg-d)		HQ		Risk Apportionment (% of COPC uptake for each dietary item)
Chemical	**Swallow stomach contents**	**Total**	**NOAEL**	**LOAEL**	**Swallow stomach contents**
Inorganics					
Cadmium	2.99	3.02E+00	**2.08E+00**	1.51E-01	100
Chromium	189	1.91E+02	**1.91E+02**	**3.82E+01**	100
Lead	1.57	1.58E+00	**1.40E+00**	1.40E-01	100
Methylmercury	0.13715	1.38E-01	**2.16E+01**	**2.16E+00**	100

TABLE E-20
Apportionment of Risk Average Plow Shop Pond Tree Swallow

	Uptake (mg/kg-d)		HQ		Risk Apportionment (% of COPC uptake for each dietary item)
Chemical	**Swallow stomach contents**	**Total**	**NOAEL**	**LOAEL**	**Swallow stomach contents**
Chromium	1.18E+02	1.18E+02	**118**	**24**	100
Lead	1.26E+00	1.26E+00	**1.1**	0.1	100
Methylmercury	1.28E-01	1.28E-01	**20**	**2.0**	100

Appendix F
Adjustment of Hazard Quotients for Wildlife Species based on Taxonomic Differences in Prey Items

TABLE F-1
MAX HQ Adjustment for Mercury by Fish Species Plow Shop Pond Raccoon

	EPCs								TRV (mg/kg-d)		HQ	
Chemical	**Sediment (mg/kg)**	**Surface Water (mg/L)**	**Fish (mg/kg)**	**Invertebrates (mg/kg)**	**Frog (mg/kg)**	**Swallow Eggs (mg/kg)**	**Plants (mg/kg)**	**Uptake[a] (mg/kg-d)**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Methylmercury												
all species	8.19E-02		2.57E+00	5.60E-02	2.24E-01	1.06E+00	1.35E-03	0.20	0.03	0.16	**6.21**	**1.24**
largemouth bass	8.19E-02		2.57E+00	5.60E-02	2.24E-01	1.06E+00	1.35E-03	0.20	0.03	0.16	**6.21**	**1.24**
bullhead	8.19E-02		3.80E-01	5.60E-02	2.24E-01	1.06E+00	1.35E-03	0.09	0.03	0.16	**2.77**	0.55
bluegill	8.19E-02		5.10E-01	5.60E-02	2.24E-01	1.06E+00	1.35E-03	0.10	0.03	0.16	**2.97**	0.59
black crappie	8.19E-02		6.70E-01	5.60E-02	2.24E-01	1.06E+00	1.35E-03	0.10	0.03	0.16	**3.23**	0.65

TABLE F-2
Max HQ Adjustment by Fish Species Plow Shop Pond Mink

	EPCs				TRV (mg/kg-d)		HQ	
Chemical	**Sediment (mg/kg)**	**Surface Water (mg/L)**	**Fish (mg/kg)**	**Uptake[a] (mg/kg-d)**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Methylmercury								
All species	8.19E-02		**2.57E+00**	0.36	0.03	0.16	**11.11**	**2.22**
Largemouth bass	8.19E-02		**2.57E+00**	0.36	0.03	0.16	**11.11**	**2.22**
bullhead	8.19E-02		**3.80E-01**	0.05	0.03	0.16	**1.65**	0.33
bluegill	8.19E-02		**5.10E-01**	0.07	0.03	0.16	**2.21**	0.44
black crappie	8.19E-02		**6.65E-01**	0.09	0.03	0.16	**2.88**	0.58

TABLE F-3
Max HQ Adjustment for Mercury by Fish Species Grove Pond Black Crowned Night Heron

	EPCs						TRV (mg/kg-d)		HQ	
Chemical	**Sediment (mg/kg)**	**Surface Water (mg/L)**	**Fish (mg/kg)**	**Invertebrates (mg/kg)**	**Frog (mg/kg)**	**Uptake[a] (mg/kg-d)**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Methylmercury										
All Species	0.07044	2.51E-07	1.09E+00	4.60E-02	2.43E-01	0.12	0.01	0.06	**18.97**	**1.90**
Brown Bullhead	0.07044	2.51E-07	3.32E-02	4.60E-02	2.43E-01	0.03	0.01	0.06	**4.48**	0.45
Yellow Bullhead	0.07044	2.51E-07	1.22E-01	4.60E-02	2.43E-01	0.04	0.01	0.06	**5.69**	0.57
Bluegill	0.07044	2.51E-07	2.23E-01	4.60E-02	2.43E-01	0.05	0.01	0.06	**7.08**	0.71
Largemouth Bass	0.07044	2.51E-07	1.09E+00	4.60E-02	2.43E-01	0.12	0.01	0.06	**18.92**	**1.89**
Pickerel	0.07044	2.51E-07	5.89E-01	4.60E-02	2.43E-01	0.08	0.01	0.06	**12.10**	**1.21**
Black Crappie	0.07044	2.51E-07	<0.21	4.60E-02	2.43E-01	0.03	0.01	0.06	**4.02**	0.40

TABLE F-4
Max HQ Adjustment for Mercury by Fish Species Plow Shop Pond Black-Crowned Night Heron

	EPCs						TRV (mg/kg-d)		HQ	
Chemical	**Sediment (mg/kg)**	**Surface Water (mg/L)**	**Fish (mg/kg)**	**Invertebrates (mg/kg)**	**Frog (mg/kg)**	**Uptake[a] (mg/kg-d)**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Methylmercury										
All species	8.19E-02		2.57E+00	5.60E-02	2.24E-01	2.50E-01	6.40E-03	6.40E-02	**39**	**3.9**
Largemouth bass	8.19E-02		2.57E+00	5.60E-02	2.24E-01	2.50E-01	6.40E-03	6.40E-02	**39**	**3.9**
bullhead	8.19E-02		3.80E-01	5.60E-02	2.24E-01	5.84E-02	6.40E-03	6.40E-02	**9.1**	0.9
Bluegill	8.19E-02		5.13E-01	5.60E-02	2.24E-01	7.00E-02	6.40E-03	6.40E-02	**11**	**1.1**
Black crappie	8.19E-02		6.65E-01	5.60E-02	2.24E-01	8.34E-02	6.40E-03	6.40E-02	**13**	**1.3**

TABLE F-5
Average HQ Adjustment for Mercury by Fish Species Plow Shop Pond Black -Crowned Night Heron

	EPCs						TRV (mg/kg-d)		HQ	
Chemical	Sediment (mg/kg)	Surface Water (mg/L)	Fish (mg/kg)	Invertebrates (mg/kg)	Frog (mg/kg)	Uptake[a] (mg/kg-d)	NOAEL	LOAEL	NOAEL	LOAEL
Methylmercury										
All species	3.67E-02		5.86E-01	2.48E-02	6.37E-02	5.94E-02	6.40E-03	6.40E-02	**9.3**	0.9
Largemouth bass	3.67E-02		1.32E+00	2.48E-02	6.37E-02	1.24E-01	6.40E-03	6.40E-02	**19**	**1.9**
Bullhead	3.67E-02		2.68E-01	2.48E-02	6.37E-02	3.15E-02	6.40E-03	6.40E-02	**4.9**	0.5
Bluegill	3.67E-02		2.97E-01	2.48E-02	6.37E-02	3.40E-02	6.40E-03	6.40E-02	**5.3**	0.5
Black crappie	3.67E-02		5.90E-01	2.48E-02	6.37E-02	5.97E-02	6.40E-03	6.40E-02	**9.3**	0.9

TABLE F-6
Max HQ Adjustment for Mercury by Fish Species Grove Pond Belted Kingfisher

	EPCs			TRV (mg/kg-d)		HQ	
Chemical	**Surface Water (mg/L)**	**Fish (mg/kg)**	**Uptake[a] (mg/kg-d)**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Methylmercury							
All Species	2.51E-07	1.09E+00	0.54	0.0064	0.06	**84**	**8.4**
Brown Bullhead	2.51E-07	3.32E-02	0.02	0.0064	0.06	**2.6**	0.26
Yellow Bullhead	2.51E-07	1.22E-01	0.06	0.0064	0.06	**9.4**	0.94
Bluegill	2.51E-07	2.23E-01	0.11	0.0064	0.06	**17**	**1.7**
Largemouth Bass	2.51E-07	1.09E+00	0.54	0.0064	0.06	**84**	**8.4**
Pickerel	2.51E-07	5.89E-01	0.29	0.0064	0.06	**45**	**4.5**
Black Crappie	2.51E-07	<0.21	0.00	0.0064	0.06	4.31E-06	4.31E-07
DDE							
All Species		2.70E-01	0.13	0.01	0.14	**9.5**	0.95
Brown Bullhead		4.00E-02	0.02	0.01	0.14	**1.4**	0.14
Yellow Bullhead		1.10E-01	0.05	0.01	0.14	**3.9**	0.39
Bluegill		1.30E-01	0.06	0.01	0.14	**4.6**	0.46
Largemouth Bass		2.70E-01	0.13	0.01	0.14	**9.5**	0.95
Pickerel		1.70E-01	0.08	0.01	0.14	**6.0**	0.60
Black Crappie		1.20E-01	0.06	0.01	0.14	**4.2**	0.42

TABLE F-7
Average HQ Adjustment for Mercury by Fish Species Grove Pond Belted Kingfisher

	EPCs			TRV (mg/kg-d)		HQ	
Chemical	**Surface Water (mg/L)**	**Fish (mg/kg)**	**Uptake[a] (mg/kg-d)**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Methylmercury							
Brown bullhead		2.04E-02	0.01	0.0064	0.06	**1.6**	0.16
Yellow Bullhead		7.90E-02	0.04	0.0064	0.06	**6.1**	0.61
Bluegill		1.60E-01	0.08	0.0064	0.06	**12**	**1.2**
Largemouth bass		3.57E-01	0.18	0.0064	0.06	**28**	**2.8**
pickerel		0.62	0.31	0.0064	0.06	**48**	**4.8**
black crappie		ND	NA	0.0064	0.06	NA	NA

TABLE F-8
Max HQ Adjustment for Mercury by Fish Species Plow Shop Pond Belted Kingfisher

	EPCs			TRV (mg/kg-d)		HQ	
Chemical	Surface Water (mg/L)	Fish (mg/kg)	Uptake[a] (mg/kg-d)	NOAEL	LOAEL	NOAEL	LOAEL
Methylmercury							
All species		2.57E+00	1.27E+00	6.40E-03	6.40E-02	**198**	**20**
Largemouth bass		2.57E+00	1.27E+00	6.40E-03	6.40E-02	**198**	**20**
bullhead		3.80E-01	1.87E-01	6.40E-03	6.40E-02	**29**	**2.9**
Bluegill		5.40E-01	2.66E-01	6.40E-03	6.40E-02	**42**	**4.2**
Black crappie		6.65E-01	3.28E-01	6.40E-03	6.40E-02	**51**	**5.1**
4,4'-DDE							
All species		3.80E-01	1.87E-01	1.40E-02	1.40E-01	**13**	**1.3**
Largemouth bass		3.80E-01	1.87E-01	1.40E-02	1.40E-01	**13**	**1.3**
bullhead		3.30E-02	1.63E-02	1.40E-02	1.40E-01	**1.2**	0.1
Bluegill		1.60E-01	7.89E-02	1.40E-02	1.40E-01	**5.6**	0.6
Black crappie		1.80E-01	8.88E-02	1.40E-02	1.40E-01	**6.3**	0.6

TABLE F-9
Average HQ Adjustment for Mercury by Fish Species Plow Shop Pond Belted Kingfisher

	EPCs			TRV (mg/kg-d)		HQ	
Chemical	Surface Water (mg/L)	Fish (mg/kg)	Uptake[a] (mg/kg-d)	NOAEL	LOAEL	NOAEL	LOAEL
Methylmercury							
Largemouth bass		1.32E+00	6.49E-01	6.40E-03	6.40E-02	**101**	**10**
Bullhead		2.68E-01	1.32E-01	6.40E-03	6.40E-02	**21**	**2.1**
Bluegill		2.97E-01	1.47E-01	6.40E-03	6.40E-02	**23**	**2.3**
Black crappie		5.89E-01	2.91E-01	6.40E-03	6.40E-02	**45**	**4.5**

Appendix G
Residual Risk Evaluation

TABLE G-1
Grove Pond BSAFs

Max EPCs

		Aquatic Invertebrates		Frogs		Swallow Eggs	
Chemical	Sediment (mg/kg)	Measured Concentration (mg/kg ww)	BSAF	Measured Concentration (mg/kg ww)	BSAF	Measured Concentration (mg/kg ww)	BSAF
Aluminum	90000	30	3.33E-04	108	1.20E-03		
Arsenic	910	1.72	1.89E-03	0.478	5.25E-04	0.95	1.04E-03
Barium	470	37.5	7.98E-02	13.7	2.91E-02		
Beryllium	14.1	NA	NA	ND	0		
Cadmium	730	1.07	1.47E-03	0.269	3.68E-04	0.53	7.26E-04
Chromium	52000	3.54	6.81E-05	11.4	2.19E-04	0.61	1.17E-05
Copper	13000	25.4	1.95E-03	59.2	4.55E-03		
Lead	1760	0.89	5.06E-04	2.69	1.53E-03	0.47	2.67E-04
Manganese	2500	785	3.14E-01	70.3	2.81E-02		
Mercury (inorganic)	422	0.051	1.21E-04	0.239	5.66E-04	1.075	2.55E-03
Methylmercury	0.07044	0.046	6.53E-01	0.243	3.45E+00		
Selenium	41.2	nd	0.00E+00	0.644	1.56E-02		
Vanadium	140	NA	NA	0.308	2.20E-03		

Avg EPCs

		Aquatic Invertebrates		Frogs		Swallow Eggs	
Chemical	Sediment (mg/kg)	Measured Concentration (mg/kg ww)	BSAF	Measured Concentration (mg/kg ww)	BSAF	Measured Concentration (mg/kg ww)	BSAF
Aluminum	1.07E+04	26.7	2.50E-03	22	2.06E-03		
Arsenic	7.89E+01	0.9	1.09E-02	0.14	1.81E-03	0.248	3.14E-03
Barium	8.28E+01	30.5	3.69E-01	4.78	5.78E-02		
Beryllium	1.17E+00	NA	NA	ND	0		
Cadmium	1.79E+01	0.2	1.36E-02	0.07	4.04E-03	0.079	4.42E-03
Chromium	5.86E+03	1.2	2.13E-04	1.18	2.02E-04	0.215	3.66E-05
Copper	1.46E+02	19.0	1.30E-01	5.89	4.04E-02		
Lead	2.63E+02	0.4	1.33E-03	0.51	1.93E-03	0.216	8.23E-04
Manganese	5.97E+02	719.3	1.20E+00	23	3.86E-02		
Mercury (inorganic)	2.19E+01	0.0319	1.46E-03	0.072	3.29E-03	0.5742	2.62E-02
Methylmercury	2.15E-02	0.0256	1.19E+00	0.080	3.74E+00	0.5742	2.67E+01
Selenium	7.61E+00	ND	0	0.25	3.27E-02		
Vanadium	3.24E+01	NA	NA	0.25	7.72E-03		

TABLE G-2
Plow Shop Pond BSAFs

Max EPCs

		Aquatic Invertebrates		Frogs		Swallow Eggs	
Chemical	**Sediment (mg/kg dw)**	**Measured Concentration (mg/kg ww)**	**BSAF**	**Measured Concentration (mg/kg ww)**	**BSAF**	**Measured Concentration (mg/kg ww)**	**BSAF**
Aluminum	27000	2.94	1.09E-04	330	1.22E-02		
Arsenic	6800	2.45	3.60E-04	0.705	1.04E-04	0.58	8.53E-05
Barium	370	95.1	2.57E-01	19.7	5.32E-02		
Beryllium	2.72	NA	NA	nd	0.00E+00		
Cadmium	66	0.62	9.39E-03	0.29	4.39E-03	ND	0.00E+00
Chromium	37800	3.19	8.44E-05	10.8	2.86E-04	0.47	1.24E-05
Copper	3450	24.4	7.07E-03	5.29	1.53E-03		
Lead	1214.31	0.47	3.87E-04	1.09	8.98E-04	0.47	3.87E-04
Manganese	54800	1042	1.90E-02	47.5	8.67E-04		
Mercury (inorganic)	250	0.069	2.76E-04	0.201	8.04E-04	1.059	4.24E-03
Methylmercury	0.08189	0.056	6.84E-01	0.224	2.74E+00	1.059	1.29E+01
Selenium	14.7	0.18	1.22E-02	0.797	5.42E-02		
Vanadium	166	NA	NA	0.693	4.17E-03		

Avg EPCs

		Aquatic Invertebrates		Frogs		Swallow Eggs	
Chemical	**Sediment (mg/kg dw)**	**Measured Concentration (mg/kg ww)**	**BSAF**	**Measured Concentration (mg/kg ww)**	**BSAF**	**Measured Concentration (mg/kg ww)**	**BSAF**
Aluminum	8228	2.03	2.47E-04	74.9	9.11E-03		
Arsenic	542	1.03	1.90E-03	0.3	4.72E-04	0.191	3.53E-04
Barium	101	62	6.20E-01	7.2	7.19E-02		
Beryllium	1.42	NA	NA	ND	0		
Cadmium	10	0.23	2.20E-02	0.1	1.15E-02	ND	0
Chromium	2275	1.24	5.46E-04	1.6	7.25E-04	0.217	9.55E-05
Copper	123	4.08	3.33E-02	2.6	2.16E-02		
Lead	169	0.17	9.94E-04	0.4	2.59E-03	0.204	1.21E-03
Manganese	2348	672	2.86E-01	16.8	7.14E-03		
Mercury (inorganic)	27	0.04	1.65E-03	0.1	2.30E-03	0.615	2.28E-02
Methylmercury	0.04	0.02	6.77E-01	0.1	1.74E+00	0.615	1.68E+01
Selenium	14	0.17	1.20E-02	0.4	2.72E-02		
Vanadium	27	NA	NA	0.3	1.25E-02		

TABLE G3

Summary of Site-Specif BSAF for Grove Pond and Plow Shop[and Plow Shop Pond used for Background FCM

Aquatic Invertebrates

Chemical	Sediment (mg/kg)	BSAF	Sediment (mg/kg)	BSAF	Sediment (mg/kg dw)	BSAF	Sediment (mg/kg dw)	BSAF
Aluminum	90000	3.33E-04	10676	2.50E-03	27000	1.09E-04	8228	2.47E-04
Arsenic	910	1.89E-03	79	1.09E-02	6800	3.60E-04	542	1.90E-03
Barium	470	7.98E-02	83	3.69E-01	370	2.57E-01	101	6.20E-01
Beryllium	14.1	NA	1.2	NA	2.72	NA	1.42	NA
Cadmium	730	1.47E-03	18	1.36E-02	66	9.39E-03	10	2.20E-02
Chromium	52000	6.81E-05	5859	2.13E-04	37800	8.44E-05	2275	5.46E-04
Copper	13000	1.95E-03	146	1.30E-01	3450	7.07E-03	123	3.33E-02
Lead	1760	5.06E-04	263	1.33E-03	1214.31	3.87E-04	169	9.94E-04
Manganese	2500	3.14E-01	597	1.20E+00	54800	1.90E-02	2348	2.86E-01
Mercury (inorganic)	422	1.21E-04	22	1.46E-03	250	2.76E-04	27	1.65E-03
Methylmercury	0.07044	6.53E-01	0.021	1.19E+00	0.08189	6.84E-01	0.04	6.77E-01
Selenium	41.2	0	7.6	0	14.7	1.22E-02	14	1.20E-02
Vanadium	140	NA	32	NA	166	NA	27	NA

Frogs

Chemical	Sediment (mg/kg)	BSAF	Sediment (mg/kg)	BSAF	Sediment (mg/kg dw)	BSAF	Sediment (mg/kg dw)	BSAF
Aluminum	90000	1.20E-03	10676	2.06E-03	27000	1.22E-02	8228	9.11E-03
Arsenic	910	5.25E-04	79	1.81E-03	6800	1.04E-04	542	4.72E-04
Barium	470	2.91E-02	83	5.78E-02	370	5.32E-02	101	7.19E-02
Beryllium	14.1	0	1.2	0	2.72	0	1.42	0
Cadmium	730	3.68E-04	18	4.04E-03	66	4.39E-03	10	1.15E-02
Chromium	52000	2.19E-04	5859	2.02E-04	37800	2.86E-04	2275	7.25E-04
Copper	13000	4.55E-03	146	4.04E-02	3450	1.53E-03	123	2.16E-02
Lead	1760	1.53E-03	263	1.93E-03	1214.31	8.98E-04	169	2.59E-03
Manganese	2500	2.81E-02	597	3.86E-02	54800	8.67E-04	2348	7.14E-03
Mercury (inorganic)	422	5.66E-04	22	3.29E-03	250	8.04E-04	27	2.30E-03
Methylmercury	0.07044	3.45E+00	0.021	3.74E+00	0.08189	2.74E+00	0.04	1.74E+00
Selenium	41.2	1.56E-02	8	3.27E-02	14.7	5.42E-02	14	2.72E-02
Vanadium	140	2.20E-03	32	7.72E-03	166	4.17E-03	27	1.25E-02

Swallow

Chemical	Sediment (mg/kg)	BSAF	Sediment (mg/kg)	BSAF	Sediment (mg/kg dw)	BSAF	Sediment (mg/kg dw)	BSAF
Aluminum	90000		10676		27000		8228	
Arsenic	910	1.04E-03	79	3.14E-03	6800	8.53E-05	542	3.53E-04
Barium	470		83		370		101	
Beryllium	14.1		1.2		2.72		1.42	
Cadmium	730	7.26E-04	18	4.42E-03	66	0	10	0
Chromium	52000	1.17E-05	5859	3.66E-05	37800	1.24E-05	2275	9.55E-05
Copper	13000		146		3450		123	
Lead	1760	2.67E-04	263	8.23E-04	1214.31	3.87E-04	169	1.21E-03
Manganese	2500		597		54800		2348	
Mercury (inorganic)	422	2.55E-03	22	2.62E-02	250	4.24E-03	27	2.28E-02
Methylmercury	0.07044		0.021	2.67E+01	0.08189	1.29E+01	0.04	1.68E+01
Selenium	41.2		8		14.7		14	
Vanadium	140		32		166		27	

Shaded = BSAF for sediment concentration closest to background sediment concentration.

TABLE G-4
Bioaccumulation Factors used for Background FMC Calculations

Chemical	Aquatic Invertebrate BSAF[a]	Notes	Frog BSAF[a]	Notes	Swallow Egg BSAF[a]	Notes	PUF[d]	Notes
Inorganics								
Aluminum	2.47E-04	b	9.11E-03	b			0.004	c
Antimony	NA		NA		NA		NA	
Arsenic	1.09E-02	b	1.81E-03	b	3.14E-03	b	0.036	c
Barium	3.69E-01	b	5.78E-02	b			0.15	c
Beryllium	0.9	c	0	b			0.01	c
Cadmium	2.20E-02	b	1.15E-02	b	0	b	0.364	c
Chromium	5.46E-04	b	7.25E-04	b	9.55E-05	b	0.0075	c
Cobalt	1	e	1	h			1	e
Copper	3.33E-02	b	2.16E-02	b			0.4	c
Lead	9.94E-04	b	2.59E-03	b	1.21E-03	b	0.045	c
Manganese	1.20E+00	b	3.86E-02	b			1	e
Mercury (Total)	1.46E-03	b	3.29E-03	b	2.62E-02	b	0.0375	c
Mercury (Methyl)	1.19E+00	b	3.74E+00	b	2.67E+01	b	0.137	c
Selenium	NA		NA		NA		NA	
Thallium	NA		NA		NA		NA	
Vanadium	1	e	7.72E-03	b			1	e
Pesticides/PCBs								
4,4'-DDD	0.95	c,f					0.00937	c,f
4,4'-DDE	0.95	c					0.00937	c
4,4'-DDT	0.95	c,f					0.00937	c,f
Total PCBs	0.53	c,g					0.01	c,g
SVOC								
Total PAH	1.24	c					0.02	c

NA = chemical was not detected in background sediment; BSAF modeling not applicable.
a. BSAFs are in (Mg COCP/Kg wet tissue)/(mg COPC/kg dry sediment).
b. BSAFs calculated from Grove Pond and Plow Shop sediment data and invertebrate, frog, and egg data.
c. BSAFs are from USEPA. 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities.
d. Plant Uptake Factor (PUF) in (Mg COPC/Kg dry plant tissue)/(mg COPC/Kg dry sediment)
e. Conservative assumption in absence of literature value.
f. Values for DDT and DDT based on value for DDE as surrogate.
g. Value for Total PCB based on value for Aroclor 1254 as surrogate.
h. In the absence of a Grove Pond/ Plow Shop Pond derived BSAF or a literature value, the BSAF for invertebrates was used.

TABLE G-5
Background Maximum Exposure Point Concentrations

Chemical	Surface Water (mg/L)	Sediment (mg/kg)	Fish (mg/kg ww)	Aquatic Invertebrates (mg/kg ww)[a]	Frogs (mg/kg ww)[a]	Swallow Eggs (mg/kg ww)[a,b]	Plants (mg/kg dw)[c]	Plants (mg/kg ww)[d]
Inorganics								
Aluminum	7.20E-01	7.80E+03	7.80E+00	1.93E+00	7.10E+01	1.93E+00	3.12E+01	3.74E+00
Antimony	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	5.80E-04	1.10E+02	ND	1.20E+00	2.00E-01	1.20E+00	3.96E+00	4.75E-01
Barium	7.60E-03	9.20E+01	3.50E+00	3.39E+01	5.31E+00	3.39E+01	1.38E+01	1.66E+00
Beryllium	ND	1.10E+00	ND	9.90E-01	0.00E+00	9.90E-01	1.10E-02	1.32E-03
Cadmium	ND	1.30E+01	ND	2.86E-01	1.50E-01	0.00E+00	4.73E+00	5.68E-01
Chromium	2.00E-03	2.10E+01	8.40E-01	1.15E-02	1.52E-02	2.01E-03	1.58E-01	1.89E-02
Cobalt	7.20E-04	1.20E+01	ND	1.20E+01	1.20E+01	1.20E+01	1.20E+01	1.44E+00
Copper	3.00E-03	3.60E+01	5.10E-01	1.20E+00	7.77E-01	1.20E+00	1.44E+01	1.73E+00
Lead	3.50E-03	2.00E+02	ND	1.99E-01	5.18E-01	2.42E-01	9.00E+00	1.08E+00
Manganese	3.10E-01	6.90E+02	3.70E+01	8.28E+02	2.66E+01	8.28E+02	6.90E+02	8.28E+01
Mercury (inorganic)	ND	3.00E-01	1.50E-02	4.38E-04	9.88E-04	7.86E-03	1.13E-02	1.35E-03
Mercury (Methyl)[e,f]	NA	1.50E-02	2.85E-01	1.79E-02	5.62E-02	4.01E-01	2.06E-03	2.47E-04
Selenium	ND	ND	ND	ND	ND	ND	ND	ND
Thallium	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	1.30E-03	3.90E+01	ND	3.90E+01	3.01E-01	3.90E+01	3.90E+01	4.68E+00
Pesticides/PCBs								
4,4'-DDD	ND	5.00E-02	3.30E-02	4.75E-02	4.75E-02	4.75E-02	4.69E-04	5.62E-05
4,4'-DDE	ND	1.70E-01	2.80E-01	1.62E-01	1.62E-01	1.62E-01	1.59E-03	1.91E-04
4,4'-DDT	ND	7.20E-03	ND	6.84E-03	6.84E-03	6.84E-03	6.75E-05	8.10E-06
Total PCBs	ND	ND	ND	NA	NA	NA	NA	NA
SVOC								
Total PAH	NA	1.23E+01	NA	1.53E+01	1.53E+01	1.53E+01	2.47E-01	2.96E-02

NA indicates chemical was not analyzed in abiotic medium and cannot be estimated in tissue using bioaccumulation factors.
a. Concentration estimated by multiplying maximum sediment concentration by BSAF in Table [G-4].
b. Based on invertebrate EPCs in absence of BSAF for bird eggs.
c. Concentration estimated by multiplying maximum sediment concentration by PUF in Table [G-4].
d. The plant EPC been converted to wet weight from dry weight by multiplying by (1-%moisture), with % moisture assumed to equal 88%.
e. MeHg concentration in sediment calculated from total Hg concentration using the assumption that 5% of Hg in sediment is MeHg.
f. MeHg concentration in fish calculated from total Hg concentration using the assumption that 95% of Hg in fish is MeHg.

TABLE G-6
Maximum Background Uptake and Hazard Quotient Calculations - Raccoon

	EPCs								TRV (mg/kg-d)		HQ	
Chemical	**Sediment (mg/kg)**	**Surface Water (mg/L)**	**Fish (mg/kg)**	**Invertebrates (mg/kg)**	**Frog (mg/kg)**	**Swallow Eggs (mg/kg)**	**Plants (mg/kg)**	**Uptake[a] (mg/kg-d)**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Inorganics												
aluminum	7.80E+03	7.20E-01	7.80E+00	1.93E+00	7.10E+01	1.93E+00	3.74E+00	181.38	1.93	19.30	94	9.4
Antimony								0.00	0.13	1.25	0.0	0.0
arsenic	1.10E+02	5.80E-04		1.20E+00	2.00E-01	1.20E+00	4.75E-01	2.64	0.13	1.26	21	2.1
barium	9.20E+01	7.60E-03	3.50E+00	3.39E+01	5.31E+00	3.39E+01	1.66E+00	6.00	5.10	15.30	1.2	0.4
Beryllium	1.10E+00			9.90E-01	0.00E+00	9.90E-01	1.32E-03	0.12	0.66	1.98	0.2	0.1
cadmium	1.30E+01			2.86E-01	1.50E-01	0.00E+00	5.68E-01	0.33	1.00	3.00	0.3	0.1
Cobalt	1.20E+01	7.20E-04		1.20E+01	1.20E+01	1.20E+01	1.44E+00	2.13	7.33	18.90	0.3	0.1
copper	3.60E+01	3.00E-03	5.10E-01	1.20E+00	7.77E-01	1.20E+00	1.73E+00	1.05	11.70	15.40	0.1	0.1
lead	2.00E+02	3.50E-03		1.99E-01	5.18E-01	2.42E-01	1.08E+00	4.62	8.00	80.00	0.6	0.1
manganese	6.90E+02	3.10E-01	3.70E+01	8.28E+02	2.66E+01	8.28E+02	8.28E+01	104.72	88.00	284.00	1.2	0.4
Mercury (Methyl)	1.50E-02		2.85E-01	1.79E-02	5.62E-02	4.01E-01	2.47E-04	0.04	0.03	0.16	1.2	0.2
selenium								0.00	0.20	0.33	0.0	0.0
Thallium								0.00	0.01	0.07	0.0	0.0
vanadium	3.90E+01	1.30E-03		3.90E+01	3.01E-01	3.90E+01	4.68E+00	4.96	0.21	2.10	24	2.4
SVOC												
PAH (Total)	1.23E+01			1.53E+01	1.53E+01	1.53E+01	2.96E-02	2.59	1.00	3.00	2.6	0.9

Blank spaces are non-detected (zero) values, although the chemical was analyzed.

a. Uptake=(FIR*(EPC$_{SD}$*SD+EPC$_{FI}$*FI+EPC$_{IN}$*IN+EPC$_{FR}$*FR+EPC$_{EG}$*EG+EPC$_{PL}$*PL)+WIR*EPC$_{SW}$)*AUF/BW

Exposure parameters as presented in Table X are the following:					
Symbol	**Value**	**Units**			
BW	5.67	Kg			
FIR	1.43E+00	Kg/day			
FI	0.2	unitless			
IN	0.2	unitless			
FR	0.2	unitless			
EG	0.2	unitless			
PL	0.11	unitless			
SD	0.09	unitless			
WIR	0.468	L/d			
AUF	1	unitless			

TABLE G- 7
Maximum Background Uptake and Hazard Quotient Calculations - Mink

	EPCs				TRV (mg/kg-d)		HQ	
Chemical	Sediment (mg/kg)	Surface Water (mg/L)	Fish (mg/kg)	Uptake[a] (mg/kg-d)	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics								
aluminum	7.80E+03	7.20E-01	7.80E+00	12.06	1.93	19.30	6.25	0.62
arsenic	1.10E+02	5.80E-04		0.15	0.13	1.26	1.22	0.12
cadmium	1.30E+01			0.02	1.00	3.00	0.02	0.01
copper	3.60E+01	3.00E-03	5.10E-01	0.12	11.70	15.40	0.01	0.01
manganese	6.90E+02	3.10E-01	3.70E+01	6.12	88.00	284.00	0.07	0.02
Mercury (Methyl)	1.50E-02		2.85E-01	0.04	0.03	0.16	1.24	0.25
Thallium				0.00	0.01	0.07	0.00	0.00
Vanadium	3.90E+01	1.30E-03		0.05	0.21	2.10	0.26	0.03

Blank spaces are non-detected (zero) values, although the chemical was analyzed.

a. Uptake=(FIR*(EPC$_{SD}$*SD+EPC$_{FI}$*FI)+WIR*EPC$_{SW}$)

Exposure parameters as presented in Table X are the following:					
Symbol	**Value**	**Units**			
BW	1.40	Kg			
FIR	1.96E-01	Kg/day			
FI	0.99	unitless			
SD	0.01	unitless			
WIR	0.111	L/d			
HR	2.24	Km shoreline			
AUF	1	unitless			

TABLE G-8
Maximum Background Uptake and Hazard Quotient Calculations - Belted

	EPCs			TRV (mg/kg-d)		HQ	
Chemical	Surface Water (mg/L)	Fish (mg/kg)	Uptake[a] (mg/kg-d)	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics							
arsenic	5.80E-04		0.00006	5.14	12.48	0.000012	0.000005
lead	3.50E-03		0.00039	1.13	11.30	0.000341	0.000034
Mercury (Methyl)		2.85E-01	0.14	0.01	0.06	21.97	2.20
Pesticides/PCBs							
DDD		3.30E-02	0.02	0.01	0.14	1.16	0.12
DDE		2.80E-01	0.14	0.01	0.14	9.87	0.99
Total PCB			0	0.18	1.80	0	0

Blank spaces are non-detected (zero) values, although the chemical was analyzed.

a. Uptake=(FIR*(EPC_{FI}*FI)+WIR*EPC_{SW})*AUF/BW

Exposure parameters as presented in Table X are the following:					
Symbol	Value	Units			
BW	0.15	Kg			
FIR	7.40E-02	Kg/day			
FI	1	unitless			
WIR	0.0165	L/d			
AUF	1	unitless			

TABLE G-9
Maximum Background Uptake and Hazard Quotient - Black Crowned Night Heron

	EPCs						TRV (mg/kg-d)		HQ	
Chemical	**Sediment (mg/kg)**	**Surface Water (mg/L)**	**Fish (mg/kg)**	**Invertebrates (mg/kg)**	**Frog (mg/kg)**	**Uptake[a] (mg/kg-d)**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Inorganics										
aluminum	7.80E+03	7.20E-01	7.80E+00	1.93E+00	7.10E+01	48.60	109.70	329.10	0.44	0.15
Antimony						0.00	0.13	1.25	0.00	0.00
arsenic	1.10E+02	5.80E-04		1.20E+00	2.00E-01	0.71	5.14	12.48	0.14	0.06
Beryllium	1.10E+00			9.90E-01	0.00E+00	0.09	0.66	1.98	0.14	0.05
cadmium	1.30E+01			2.86E-01	1.50E-01	0.11	1.45	20.00	0.07	0.01
chromium	2.10E+01	2.00E-03	8.40E-01	1.15E-02	1.52E-02	0.19	1.00	5.00	0.19	0.04
Cobalt	1.20E+01	7.20E-04		1.20E+01	1.20E+01	2.17	7.61	18.34	0.29	0.12
copper	3.60E+01	3.00E-03	5.10E-01	1.20E+00	7.77E-01	0.41	47.00	61.70	0.01	0.01
lead	2.00E+02	3.50E-03		1.99E-01	5.18E-01	1.13	1.13	11.30	1.00	0.10
Mercury (inorganic)	3.00E-01		1.50E-02	4.38E-04	9.88E-04	0.00	0.45	0.90	0.01	0.00
Mercury (Methyl)	1.50E-02		2.85E-01	1.79E-02	5.62E-02	0.03	0.01	0.06	4.94	0.49
Thallium						0.00	0.0074	0.074		
vanadium	3.90E+01	1.30E-03		3.90E+01	3.01E-01	3.66	11.40	34.20	0.32	0.11
Pesticides/PCBs										
DDD	5.00E-02		3.30E-02	4.75E-02	4.75E-02	0.01	0.01	0.14	0.82	0.08
DDE	1.70E-01		2.80E-01	1.62E-01	1.62E-01	0.05	0.01	0.14	3.84	0.38
DDT	7.20E-03			6.84E-03	6.84E-03	0.00	0.01	0.14	0.09	0.01

Blank spaces are non-detected (zero) values, although the chemical was analyzed.

a. Uptake=(FIR*(EPC_{SD}*SD+EPC_{FI}*FI+EPC_{IN}*IN+EPC_{FR}*FR)+WIR*EPC_{SW})*AUF/BW

Exposure parameters as presented in Table X are the following:				
Symbol	**Value**	**Units**		
BW	0.88	Kg		
FIR	2.34E-01	Kg/day		
FI	0.33	unitless		
IN	0.33	unitless		
FR	0.33	unitless		
SD	0.02	unitless		
WIR	0.0396	L/d		
AUF	1	unitless		

TABLE G-10
Maximum Background Uptake and Hazard Quotient Calculations - Tree Swallow

No background data available for tree swallow stomach contents.

TABLE G-12
Background Average Exposure Point Concentrations

Chemical	Surface Water (mg/L)	Sediment (mg/kg)	Fish (mg/kg ww)	Aquatic Invertebrates (mg/kg ww)[a]	Frogs (mg/kg ww)[a]	Swallow Eggs (mg/kg ww)[a,b]	Plants (mg/kg dw)[c]	Plants (mg/kg ww)[d]
Inorganics								
Aluminum	7.20E-01	7.10E+03	3.80E+00	1.75E+00	6.47E+01	1.75E+00	2.84E+01	3.41E+00
Antimony	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	5.80E-04	8.25E+01	ND	8.97E-01	1.50E-01	8.97E-01	2.97E+00	3.56E-01
Barium	7.60E-03	8.25E+01	2.24E+00	3.04E+01	4.77E+00	3.04E+01	1.24E+01	1.49E+00
Beryllium	ND	1.25E+00	ND	1.13E+00	0.00E+00	1.13E+00	1.25E-02	1.50E-03
Cadmium	ND	1.20E+01	ND	2.64E-01	1.38E-01	0.00E+00	4.37E+00	5.24E-01
Chromium	2.00E-03	1.75E+01	7.47E-01	9.55E-03	1.27E-02	1.67E-03	1.31E-01	1.58E-02
Cobalt	7.20E-04	1.10E+01	ND	1.10E+01	1.10E+01	1.10E+01	1.10E+01	1.32E+00
Copper	3.00E-03	3.20E+01	4.33E-01	1.07E+00	6.90E-01	1.07E+00	1.28E+01	1.54E+00
Lead	3.50E-03	1.60E+02	ND	1.59E-01	4.14E-01	1.94E-01	7.20E+00	8.64E-01
Manganese	3.10E-01	5.75E+02	2.20E+01	6.90E+02	2.22E+01	6.90E+02	5.75E+02	6.90E+01
Mercury (inorganic)	ND	1.50E-02	9.33E-03	2.19E-05	4.94E-05	3.93E-04	5.63E-04	6.75E-05
Mercury (Methyl)[e,f]	NA	2.85E-01	1.77E-01	1.79E-02	1.07E+00	7.61E+00	3.90E-02	4.69E-03
Selenium	ND	ND	ND	ND	ND	ND	ND	ND
Thallium	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	1.30E-03	3.00E+01	ND	3.00E+01	2.32E-01	3.00E+01	3.00E+01	3.60E+00
Pesticides/PCBs								
4,4'-DDD	ND	5.00E-02	2.47E-02	4.75E-02	4.75E-02	4.75E-02	4.69E-04	5.62E-05
4,4'-DDE	ND	1.70E-01	1.63E-01	1.62E-01	1.62E-01	1.62E-01	1.59E-03	1.91E-04
4,4'-DDT	ND	7.20E-03	ND	6.84E-03	6.84E-03	6.84E-03	6.75E-05	8.10E-06
Total PCBs	ND	ND	ND	NA	NA	NA	NA	NA
SVOC								
Total PAH	NA	1.23E+01	NA	1.53E+01	1.53E+01	1.53E+01	2.47E-01	2.96E-02

NA indicates chemical was not analyzed in abiotic medium and cannot be estimated in tissue using bioaccumulation factors.

a. Concentration estimated by multiplying average sediment concentration by BSAF in Table [G-4].

b. Based on invertebrate EPCs in absence of BSAF for bird eggs.

c. Concentration estimated by multiplying average sediment concentration by PUF in Table [G-4].

d. The plant EPC been converted to wet weight from dry weight by multiplying by (1-%moisture), with % moisture assumed to equal 88%.

e. MeHg concentration in sediment calculated from total Hg concentration using the assumption that 5% of Hg in sediment is MeHg.

f. MeHg concentration in fish calculated from total Hg concentration using the assumption that 95% of Hg in fish is MeHg.

TABLE G-13
Average Background Uptake and Hazard Quotient Calculations -Raccoon

	EPCs								TRV (mg/kg-d)		HQ	
Chemical	**Sediment (mg/kg)**	**Surface Water (mg/L)**	**Fish (mg/kg)**	**Invertebrates (mg/kg)**	**Frog (mg/kg)**	**Swallow Eggs (mg/kg)**	**Plants (mg/kg)**	**Uptake[a] (mg/kg-d)**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Inorganics												
aluminum	7.10E+03	7.20E-01	3.80E+00	1.75E+00	6.47E+01	1.75E+00	3.41E+00	164.94	1.93	19.30	85	8.5
Antimony								0.00	0.13	1.25	0.0	0.0
arsenic	8.25E+01	5.80E-04		8.97E-01	1.50E-01	8.97E-01	3.56E-01	1.98	0.13	1.26	16	1.6
barium	8.25E+01	7.60E-03	2.24E+00	3.04E+01	4.77E+00	3.04E+01	1.49E+00	5.34	5.10	15.30	1.0	0.3
Beryllium	1.25E+00			1.13E+00	0.00E+00	1.13E+00	1.50E-03	0.14	0.66	1.98	0.2	0.1
cadmium	1.20E+01			2.64E-01	1.38E-01	0.00E+00	5.24E-01	0.31	1.00	3.00	0.3	0.1
Cobalt	1.10E+01	7.20E-04		1.10E+01	1.10E+01	1.10E+01	1.32E+00	1.95	7.33	18.90	0.3	0.1
copper	3.20E+01	3.00E-03	4.33E-01	1.07E+00	6.90E-01	1.07E+00	1.54E+00	0.93	11.70	15.40	0.1	0.1
lead	1.60E+02	3.50E-03		1.59E-01	4.14E-01	1.94E-01	8.64E-01	3.69	8.00	80.00	0.5	0.0
manganese	5.75E+02	3.10E-01	2.20E+01	6.90E+02	2.22E+01	6.90E+02	6.90E+01	86.83	88.00	284.00	1.0	0.3
Mercury (Methyl)	2.85E-01		1.77E-01	1.79E-02	1.07E+00	7.61E+00	4.69E-03	0.45	0.03	0.16	14.2	2.8
selenium								0.00	0.20	0.33	0.0	0.0
Thallium								0.00	0.01	0.07	0.0	0.0
vanadium	3.00E+01	1.30E-03		3.00E+01	2.32E-01	3.00E+01	3.60E+00	3.82	0.21	2.10	18	1.8
SVOC												
PAH (Total)	1.23E+01			1.53E+01	1.53E+01	1.53E+01	2.96E-02	2.59	1.00	3.00	2.6	0.9

Blank spaces are non-detected (zero) values, although the chemical was analyzed.

a. Uptake=$(FIR*(EPC_{SD}*SD+EPC_{FI}*FI+EPC_{IN}*IN+EPC_{FR}*FR+EPC_{EG}*EG+EPC_{PL}*PL)+WIR*EPC_{SW})*AUF/BW$

Exposure parameters as presented in Table X are the following:					
Symbol	**Value**	**Units**			
BW	5.67	Kg			
FIR	1.43E+00	Kg/day			
FI	0.2	unitless			
IN	0.2	unitless			
FR	0.2	unitless			
EG	0.2	unitless			
PL	0.11	unitless			
SD	0.09	unitless			
WIR	0.468	L/d			
AUF	1	unitless			

TABLE G-14
Average Background Uptake and Hazard Quotient Calculations - Mink

	EPCs				TRV (mg/kg-d)		HQ	
Chemical	Sediment (mg/kg)	Surface Water (mg/L)	Fish (mg/kg)	Uptake[a] (mg/kg-d)	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics								
aluminum	7.10E+03	7.20E-01	3.80E+00	10.52	1.93	19.30	5.45	0.55
arsenic	8.25E+01	5.80E-04		0.12	0.13	1.26	0.92	0.09
cadmium	1.20E+01			0.02	1.00	3.00	0.02	0.01
copper	3.20E+01	3.00E-03	4.33E-01	0.11	11.70	15.40	0.01	0.01
manganese	5.75E+02	3.10E-01	2.20E+01	3.88	88.00	284.00	0.04	0.01
Mercury (Methyl)	2.85E-01		1.77E-01	0.02	0.03	0.16	0.78	0.16
Thallium				0.00	0.01	0.07	0.00	0.00
Vanadium	3.00E+01	1.30E-03		0.04	0.21	2.10	0.20	0.02

Blank spaces are non-detected (zero) values, although the chemical was analyzed.

a. Uptake=(FIR*(EPC$_{SD}$*SD+EPC$_{FI}$*FI)+WIR*EPC$_{SW}$)

Exposure parameters as presented in Table X are the following:					
Symbol	**Value**	**Units**			
BW	1.40	Kg			
FIR	1.96E-01	Kg/day			
FI	0.99	unitless			
SD	0.01	unitless			
WIR	0.111	L/d			
HR	2.24	Km shoreline			
AUF	1	unitless			

TABLE G-15
Average Background Uptake and Hazard Quotient Calculations - Belted Kingfisher

	EPCs			TRV (mg/kg-d)		HQ	
Chemical	Surface Water (mg/L)	Fish (mg/kg)	Uptake[a] (mg/kg-d)	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics							
arsenic	5.80E-04		0.00006	5.14	12.48	0.000012	0.000005
lead	3.50E-03		0.00039	1.13	11.30	0.000341	0.000034
Mercury (Methyl)		1.77E-01	0.09	0.01	0.06	13.67	1.37
Pesticides/PCBs							
DDD		2.47E-02	0.01	0.01	0.14	0.87	0.09
DDE		1.63E-01	0.08	0.01	0.14	5.73	0.57
Total PCB			0	0.18	1.80	0	0

Blank spaces are non-detected (zero) values, although the chemical was analyzed.

a. Uptake=$(FIR*(EPC_{FI}*FI)+WIR*EPC_{SW})*AUF/BW$

Exposure parameters as presented in Table X are the following:					
Symbol	Value	Units			
BW	0.15	Kg			
FIR	7.40E-02	Kg/day			
FI	1	unitless			
WIR	0.0165	L/d			
AUF	1	unitless			

TABLE G-16
Average Background Uptake and Hazard Quotient Calculations - Black-Crowned Night Heron

	EPCs						TRV (mg/kg-d)		HQ	
Chemical	Sediment (mg/kg)	Surface Water (mg/L)	Fish (mg/kg)	Invertebrates (mg/kg)	Frog (mg/kg)	Uptake[a] (mg/kg-d)	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics										
aluminum	7.10E+03	7.20E-01	3.80E+00	1.75E+00	6.47E+01	43.95	109.70	329.10	0.40	0.13
Antimony						0.00	0.13	1.25	0.00	0.00
arsenic	8.25E+01	5.80E-04		8.97E-01	1.50E-01	0.53	5.14	12.48	0.10	0.04
Beryllium	1.25E+00			1.13E+00	0.00E+00	0.11	0.66	1.98	0.16	0.05
cadmium	1.20E+01			2.64E-01	1.38E-01	0.10	1.45	20.00	0.07	0.00
chromium	1.75E+01	2.00E-03	7.47E-01	9.55E-03	1.27E-02	0.16	1.00	5.00	0.16	0.03
Cobalt	1.10E+01	7.20E-04		1.10E+01	1.10E+01	1.99	7.61	18.34	0.26	0.11
copper	3.20E+01	3.00E-03	4.33E-01	1.07E+00	6.90E-01	0.36	47.00	61.70	0.01	0.01
lead	1.60E+02	3.50E-03		1.59E-01	4.14E-01	0.90	1.13	11.30	0.80	0.08
Mercury (inorganic)	1.50E-02		9.33E-03	2.19E-05	4.94E-05	0.00	0.45	0.90	0.00	0.00
Mercury (Methyl)	2.85E-01		1.77E-01	1.79E-02	1.07E+00	0.11	0.01	0.06	17.55	1.75
Thallium						0.00	0.0074	0.074		
vanadium	3.00E+01	1.30E-03		3.00E+01	2.32E-01	2.81	11.40	34.20	0.25	0.08
Pesticides/PCBs										
DDD	5.00E-02		2.47E-02	4.75E-02	4.75E-02	0.01	0.01	0.14	0.77	0.08
DDE	1.70E-01		1.63E-01	1.62E-01	1.62E-01	0.04	0.01	0.14	3.11	0.31
DDT	7.20E-03			6.84E-03	6.84E-03	0.00	0.01	0.14	0.09	0.01

Blank spaces are non-detected (zero) values, although the chemical was analyzed.

a. Uptake=$(FIR*(EPC_{SD}*SD+EPC_{FI}*FI+EPC_{IN}*IN+EPC_{FR}*FR)+WIR*EPC_{SW})*AUF/BW$

Exposure parameters as presented in Table X are the following:				
Symbol	Value	Units		
BW	0.88	Kg		
FIR	2.34E-01	Kg/day		
FI	0.33	unitless		
IN	0.33	unitless		
FR	0.33	unitless		
SD	0.02	unitless		
WIR	0.0396	L/d		
AUF	1	unitless		

TABLE G-17
Average Background Uptake and Hazard Quotient Calculations - Tree Swallow

No background data available for tree swallow stomach contents.

Appendix H
Comparison of the 1994 and 2005 Sediment Toxicity Tests Performed at Plow Shop Pond

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Office of Environmental Measurement and Evaluation
US EPA - Region I
11 Technology Drive
North Chelmsford, MA 01863

July 21, 2005

To: Mr. Bart Hoskins, EPA TOPO
Via: Mr. Louis Macri, Program Manager

TDF No. 1807 C
Task Order No. 21
Task No. 2

Subject: Comparison of the 1994 and 2005 Sediment Toxicity Tests Performed at Plow Shop Pond

Dear Mr. Hoskins:

Environmental Services Assistance Team (ESAT) members, Melissa Grable, Stan Pauwels, and Rayann Richard have summarized and compared the findings of two sediment toxicity tests performed in 1994 and 2005 using surface water and sediment samples collected at the Former Fort Devens Superfund Site in Ayer, MA.

The task was requested by Bart Hoskins, the Task Order Project Officer (TOPO), and was authorized under Technical Direction Form (TDF) No. 1807 B. This TDF was modified on June 14, 2005 to request that ESAT (1) attend a meeting to discuss the plans for the final baseline ecological risk assessment, and (2) review recent toxicity test results from 2005 for comparison against toxicity tests performed in 1994 by ABB Environmental Services, Inc.

The TDF was further modified on June 21, 2005 requesting ESAT to (1) develop one or more maps displaying toxicity testing results in a readily-interpreted form, and (2) develop a narrative text, and summary tables to compare the toxicity data sets.

The TDF was modified one last time on July 14, 2005 (TDF 1807C) requesting ESAT to compile the 2005 surface water and 2004 and 2005 sediment sample location latitude and longitude values and chemical data, along with fish tissue chemical data from 2004 into one excel file. The file was saved to G:\ALLSHARE\ESATBIO\DEVENS\TOX TESTS\Master Sample Location and Data.xls

Should you have any questions or comments, please contact Rayann Richard of ESAT-Lockheed Martin at (617)-918-8648, located in the EPA/OEME Biology Section, North Chelmsford, MA.

Sincerely,

Lockheed Martin Information Technologies

Rayann Richard
Environmental Scientist

Comparison of The 1994 and 2005 Sediment Toxicity Tests Performed at Plow Shop Pond
The former Fort Devens Superfund Site
Ayer, Massachusetts

Submitted to the:

Office of Environmental Measurement and Evaluation
United States Environmental Protection Agency - New England
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Lowell, Massachusetts 01854

TDF No. 1807 C
Task Order No. 21
Task No. 2

July 21, 2005

1.0 GENERAL INTRODUCTION

On June 7, 2005, EPA issued TDF No.1807 requesting an ESAT member to attend an afternoon base realignment and closure (BRAC) cleanup team (BCT) meeting regarding the Devens Ponds site on June 9, 2005 and an evening meeting in the evening of June 9, 2005 to present a powerpoint summary of past ecological risk activities and recent toxicity testing in the ponds.

The TDF was modified on June 14, 2005 (TDF 1807A), requesting ESAT to (1) participate in a conference call to discuss plans for the final baseline ecological risk assessment for the Devens Ponds to be performed by Gannett Fleming and (2) review the recent toxicity test results for comparison against the findings of toxicity testing performed in 1994 by ABB Environmental Services, Inc.

The TDF was further modified on June 21, 2005 (TDF 1807B), requesting that ESAT (1) develop one or more maps displaying the results of all available sediment toxicity testing in Plow Shop Pond in a readily-interpreted format and develop a narrative text and summary tables to compare the various data sets.

The TDF was modified one last time on July 14, 2005 (TDF 1807C) requesting ESAT to compile the 2005 surface water and 2004 and 2005 sediment sample location latitude and longitude values and chemical data, along with fish tissue chemical data from 2004 into one excel file. The file was saved to G:\ALLSHARE\ESATBIO\DEVENS\TOX TESTS\Master Sample Location and Data.xls

The remainder of this technical memorandum is organized as follows: section 2 summarizes the sediment toxicity test procedures for the 1994 and 2005 tests, section 3 summarizes the results of the these sediment toxicity tests, section 4 provides a summary and conclusions, and section 5 provides references.

2.0 SUMMARY OF 1994 AND 2005 SEDIMENT TOXICITY TEST PROCEDURES

Two 10-day sediment toxicity tests (September 1994 and February 2005) were performed on sediment samples collected from Plow Shop Pond. Both tests evaluated the potential toxicity of sediments to aquatic organisms by conducting exposures using two freshwater invertebrates the amphipod, *H. azteca* and the insect, *C. tentans*. The following sections (2.1 and 2.2) describe the 1994 and 2005 sediment toxicity test procedures. **Table 1** summarizes the differences between the 1994 and 2005 sediment toxicity test procedures.

2.1 Sediment Toxicity Test - 1994

In September of 1994, 22 sediment samples (SHD-94-01X through SHD-94-22X) were collected from Plow Shop Pond (**Figure 1**). Sediment collected from Strohs Folly Brook in Wareham, MA was used as both the reference and control sample, referred to as the reference control sample. The overlying water used for all of the test and reference control samples was surface water collected from Plow Shop Pond. Before starting the test, all sediment samples were passed through a 2.0 mm stainless steel sieve to remove rocks, debris, and large clumps of sediment. The sediment toxicity test consisted of 10-day exposures using *H. azteca* and *C. tentans*. Biological observations and physical characteristics of the test solutions were recorded at test initiation and at each subsequent 24-hour interval. On renewal days, water quality measurements were performed on old and new test and reference control solutions. Hardness, alkalinity, and specific conductivity were measured at test initiation and termination on composite samples of overlying water from each test and reference control sample.

2.1.1 C. tentans

The 10-day *C. tentans* test evaluated survival and growth of 8-12 day old *C. tentans* larvae exposed to bulk sediment collected from Plow Shop Pond. The toxicity test was conducted according to the standard test procedures described in ASTM, “Guideline for Conducting Sediment Toxicity Tests with

Freshwater Invertebrates," (ASTM, 1993). Second instar *C. tentans* larvae were obtained from Springborn Laboratories, Inc. (SLI) cultures.

C. tentans larvae were introduced into polypropylene centrifuge tubes that contained 7.5 grams of wet sediment and 47 mL of overlying water. Fifteen replicates, each containing one *C. tentans*, were maintained for each sediment sample. The test was conducted in a temperature-controlled water bath at 22 ± 1 ºC. Renewal of the overlying water occurred once daily, by carefully siphoning off about 75% of the overlying water and replacing it with fresh Plow Shop Pond water. The organisms were fed 0.1 mL of a suspension of finely-ground flaked fish food. Survival was determined after ten days by sieving the sediment from each test replicate and removing the surviving organisms. An analytical balance was used to weigh the surviving *C. tentans* after the organisms had been dried at 60ºC for 24-hours.

Survival at test termination for each test sample was statistically compared to the performance of the reference control sample. A Fisher's Exact test was used to determine if survival was significantly different from the reference control. Survival was only analyzed for those site samples in which mean survival was less than that measured in the reference control sample. Growth was quantified as the percent growth change in the test samples relative to the reference control. The Toxicity Screening Report (ABB, 1995) did not state which statistical test was used to determine if change was significant.

2.1.2 H. azteca

The 10-day *H. azteca* test only evaluated survival of the test organisms exposed to bulk sediment samples collected from Plow Shop Pond. The toxicity test was based on standard procedures described in the 1993 ASTM "Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates." *H. azteca* larvae (7-10 days old) were obtained from SLI cultures.

H. azteca larvea were introduced into 1-Liter beakers containing 200 mL of sediment and approximately 800 mL of overlying Plow Shop Pond surface water. Five replicates, each containing 20 *H. azteca*, were maintained for each sediment sample. The test was conducted in a temperature-controlled water bath at 20 ± 1 ºC. The overlying water was renewed three times a week, by removing about 75% of the overlying water and replacing it with fresh Plow Shop Pond surface water. Every day, the *H. azteca* test vessels were fed a combination of 100 µl Tetramin Flake Fish Food and 300 µl Trout Chow suspension. Survival was determined at the end of 10 days by sieving the sediment from each test vessel to remove the surviving *H. azteca*.

Survival in each test sample was statistically compared to the reference control organisms to establish significance. Results were first analyzed using a t-test. Welch's t-test was used if different variances were observed. All statistically analyses were performed at the 95% level of certainty.

2.2 Sediment Toxicity Test - 2005

In February of 2005, a sediment toxicity test was conducted using 11 sediment samples from Plow Shop Pond, 3 sediment samples from Grove Pond, and 1 sediment sample from Flannagan Pond (reference location). The sediment toxicity test were performed in the Sediment Toxicity Testing System (STTS) at the Office of Environmental Measurement and Evaluation (OEME) laboratory.

Each test vessel consisted of a 300-mL glass beaker with Nitex-covered notched openings, designed for a flow-through system. Eight replicates per treatment were tested. Each vessel received about 100 mL of sediment, and 175 mL of overlying water. Artificial sediment was used for the laboratory control. Ninety mg $CaCO_3$ /Liter hardness process water (HPW) was used as overlying water. Prior to starting the test, the beakers received first the sediment and then the 90 HPW was added. They were left to sit overnight before introducing the organisms. Hardness and alkalinity was checked by titration with each new batch of 90 HPW prepared.

2.2.1 C. tentans and H. azteca

Ten second to third instar larval stage organisms (11-12 days old for *C. tentans* and 7-10 days old for *H. azteca*) were randomly introduced to each beaker. The organisms were carefully pipetted, keeping each one completely submerged in water from holding tray to test chamber. Only the most healthy and active organisms were selected for the test. The organisms were maintained throughout the 10-day exposure period at 23 ± 1°C in the STTS with a 16:8 hour light/dark cycle using cool-white fluorescent lights. Water renewals occurred between two and four times daily using the automatic renewal system associated with the STTS. The number of renewals was based on dissolved oxygen (DO) readings and discussions with the TOPO. All organisms were fed once a day after the morning renewal. Each *H. azteca* replicate was fed 1.0 mL of a yeast-alfalfa-trout chow mixture (YAT). Each *C. tentans* replicate was fed 1.5 mL of 4 g/L TetShake (4 g Tetramin flakes/1L distilled deionized water).

3.0 SUMMARY OF 1994 AND 2005 SEDIMENT TOXICITY RESULTS

Figure 1 summarizes the results from the 1994 and 2005 sediment toxicity test reports. This figure shows the survival and growth for the *H. azteca* and *C. tentans* exposed to sediments from Plow Shop Pond. Toxic responses were observed near Shepley's Hill Landfill (especially Red Cove) and across from the former railroad roundhouse. In general, the sediment in the northern and central portion of the pond, across from the peninsula between Red Cove and the former railroad roundhouse, and by the outlet elicited less or no toxic responses. Also, *H. azteca* was consistently more sensitive than *C. tentans*.

3.1 The Shepley's Hill Landfill

Along the shoreline adjacent to the Shepley's Hill Landfill and within Red Cove, the *H. azteca* growth was adversely affected in the 2005 samples (P-sed-11, P-sed-3, P-sed-4, P-sed-2 and P-sed-1) and significant mortality was observed in two 1994 samples (SHD-94-13X and SHD-94-07X). The exact cause of toxicity is not known, but it likely due to high concentrations of arsenic measured in that general area (See **Figure 2**).

The *C. tentans* did not demonstrate any adverse affects to sediment samples taken near the Shepley's Hill Landfill or in Red Cove. One possible explanation for the lack of response in *C. tentans* is that *H. azteca* may be more sensitive to metals such as arsenic. A toxicity study performed using metal-contaminated sediment from the Upper Clark Fork River in Montana, determined that *H. azteca* were more sensitive to metal contaminants than *C. riparius*, rainbow trout, and *Daphnia magna* (Kemble, 1994).

3.2 The Former Railroad Roundhouse

Significant mortality *in H. azteca* was observed in three samples (SHD-94-01X, SH-94-09X, and P-sed-9) along the shoreline near the former railroad roundhouse. Significant *C. tentans* mortality was observed in two samples (SH-94-09X, and P-sed-9) and significant *C. tentans* and *H. azteca* growth reduction was observed in the one sample (P-sed-9). The exact cause of toxicity is not known but is likely due to high PAH concentrations measured in this area (See **Figure 3**).

The significant toxic responses by both organisms at the P-sed-9, which is the closest sample to the former railroad roundhouse, strongly suggests that contaminants associated with the former railroad roundhouse are present in the sediment.

3.3 Culvert

Figure 1 indicates, that one sediment sample, approximately 300 feet southwest of the culvert, affected *H. azteca* in 1994 (SHD-94-10X). In 2005, a sample collected about half-way between the culvert and SHD-94-10X, did not have adverse effects on *H. azteca*l. The reason(s) for the two different responses is not known. It may mean that (1) the contamination causing the *H. azteca* toxicity in SHD-94-10X did not come from the direction of culvert, (2) the contamination may be an isolated source, (3) the contamination may be coming from the former railroad roundhouse, or (4) the 1994 and 2005 sediment samples differ spatially and temporally.

4.0 SUMMARY AND CONCLUSIONS

The 1994 and 2005 sediment toxicity test results for Plow Shop Pond were reviewed and compared. The major trends can be summarized as follows:

- *H. azteca* showed a significant toxic response in 1994 survival and 2005 growth and survival when exposed to sediments collected near the Shepley's Hill Landfill and within Red Cove.
- *H azteca* and *C. tentans* showed a significant toxic response in 1994 survival and 2005 growth and survival when exposed to sediments collected near the former railroad roundhouse.
- There was no consistent pattern of toxicity in the two benthic species exposed to sediment collected elsewhere in Plow Shop Pond.

5.0 REFERENCES

ABB Environmental Services Inc, "Fort Devens Feasibility Study for Group 1A Sites – Draft Plow Shop Pond and Grove Pond Sediment Evaluation," October 1995.

Kemble, N.E, et. al. "Toxicity of Metal-Contaminated Sediments From the Upper Clark Fork River, Montana, to Aquatic Invertebrates and Fish in Laboratory Exposures," December 1991, *Environmental Toxicology and Chemistry*, pg 1985-1997.

American Society for Testing and Materials (AMST), "Standard Guide for Conducting Sediment Toxicity Test with Freshwater Invertebrates. 1994, Volume 11.04 Designation: E1383-94 pgs. 1196-1225.

Table 1. Differences in between the 1994 and 2005 Sediment Toxicity Test Procedures

Year	Introduction Age	Replicates	Organisms per Replicate	Amount of Sediment	Temp	Number of Renewals	Type of Overlying Water	Feeding Schedule	Reference Location	Statistical Analysis
C. tentans										
1994	8-12 days	15	1	7.5 g	22 ± 1º C	One Daily renewal	Surface water from Plow Shop Pond	0.1 mL Tetramin shake daily (6g/L)	Stroh Folly Brook in Wareham, MA	Fisher's Exact test
2005	11-12 days	8	10	100 ml of semi-processed sediment+	23 ± 1º C	2-4 daily renewals	90 mg $CaCO_3$ /Liter hardness process water	1.5 ml of Tetramin Shake daily (4g/L)	Flannagan Pond in Ayer, MA	EPA Decision Tree*
H. azteca										
1994	7-10 days	5	20	200 ml of sieved sediment	20 ± 1º C	3 weekly renewals	Surface water from Plow Shop Pond	100 u/L fish flakes and 300 u/L Trout Chow daily#	Stroh Folly Brook in Wareham, MA	t-test or Welch's t-test
2005	7-10 days	8	10	100 ml of semi-processed sediment+	23 ± 1º C	2-4 daily renewals	90 mg $CaCO_3$ /Liter hardness process water	1.0 ml of a yeast-alfalfa-trout chow mixture daily	Flannagan Pond in Ayer, MA	EPA Decision Tree*

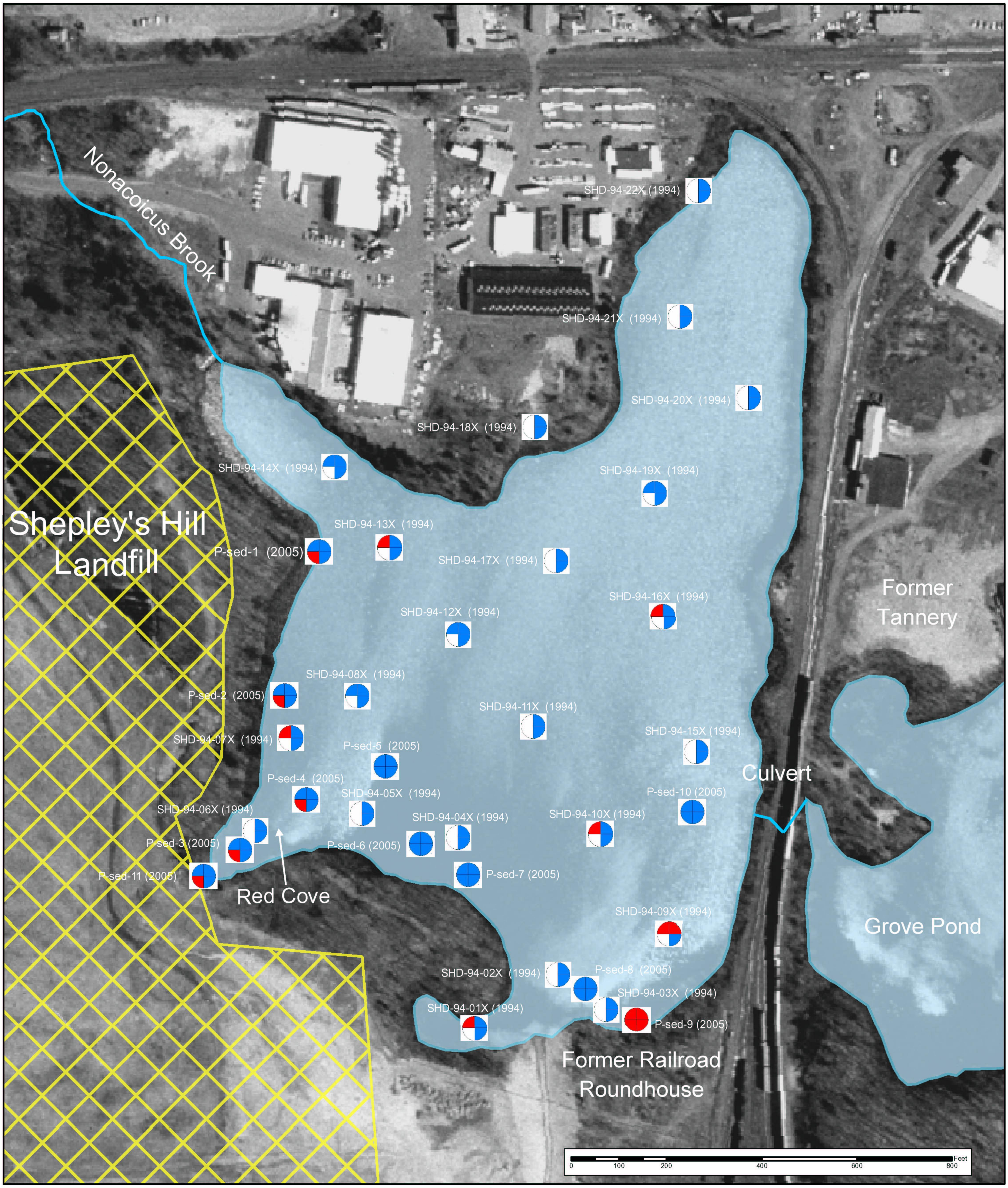
+ Removed sticks, rocks, and visible indigenous and predatory organisms.
# - Trout Chow suspension was a combination of Salmon trout food (50g) and dehydrated alfalfa (10g) mixed with dilution water (2L).
* Following the EPA Decision Tree the following types of statistical analyses were used when appropriate: Dunnett's Multiple Comparison Test, Steel's Many One Rank Test, Bonferroni-Adjusted t-Test, and Bonferroni-Adjusted Wilcoxon Rank Sum Test

Table 2. Summary of Sediment Effect Concentrations for Arsenic

Fort Devens Superfund Site
Ayer, MA

Analyte	Sample Type	Test Organism	Test Length (days)	SEC value	Concentration (ng/g = mg/kg)
Arsenic	BT	C. riparius	14	ERL	32000
Arsenic	BT	C. riparius	14	ERM	57000
Arsenic	BT	C. riparius	14	TEL	21762
Arsenic	BT	C. riparius	14	PEL	54022
Arsenic	BT	C. riparius	14	NEC	404000
Arsenic	BT	H. azteca	14	ERL	12100
Arsenic	BT	H. azteca	14	ERM	33000
Arsenic	BT	H. azteca	14	TEL	11245
Arsenic	BT	H. azteca	14	PEL	39466
Arsenic	BT	H. azteca	14	NEC	92900
Arsenic	BT	H. azteca	28	ERL	13100
Arsenic	BT	H. azteca	28	ERM	49600
Arsenic	BT	H. azteca	28	TEL	10798
Arsenic	BT	H. azteca	28	PEL	48385
Arsenic	BT	H. azteca	28	NEC	102000
Arsenic	BS	H. azteca	28	ERL	7400
Arsenic	BS	H. azteca	28	ERM	24800
Arsenic	BS	H. azteca	28	TEL	3332
Arsenic	BS	H. azteca	28	PEL	16366
Arsenic	BS	H. azteca	28	NEC	23800

Notes:
BT = Total extraction of sediment
BS = Weak acid digestion of sediment
ERL = Effect Range Low
ERM = Effect Range Median
TEL = Threshold Effect Level
PEL = Probable Effect Level
NEC = No Effect Concentration
http://www.cerc.usgs.gov/pubs/sedtox/sec.htm



Survival Survival
H. azteca C. tentans
Growth Growth

- Not statistically different from reference/control (blue)
- Statistically different from reference/control (red)
- Not tested (white)
- Solid Waste Facility (yellow crosshatch)

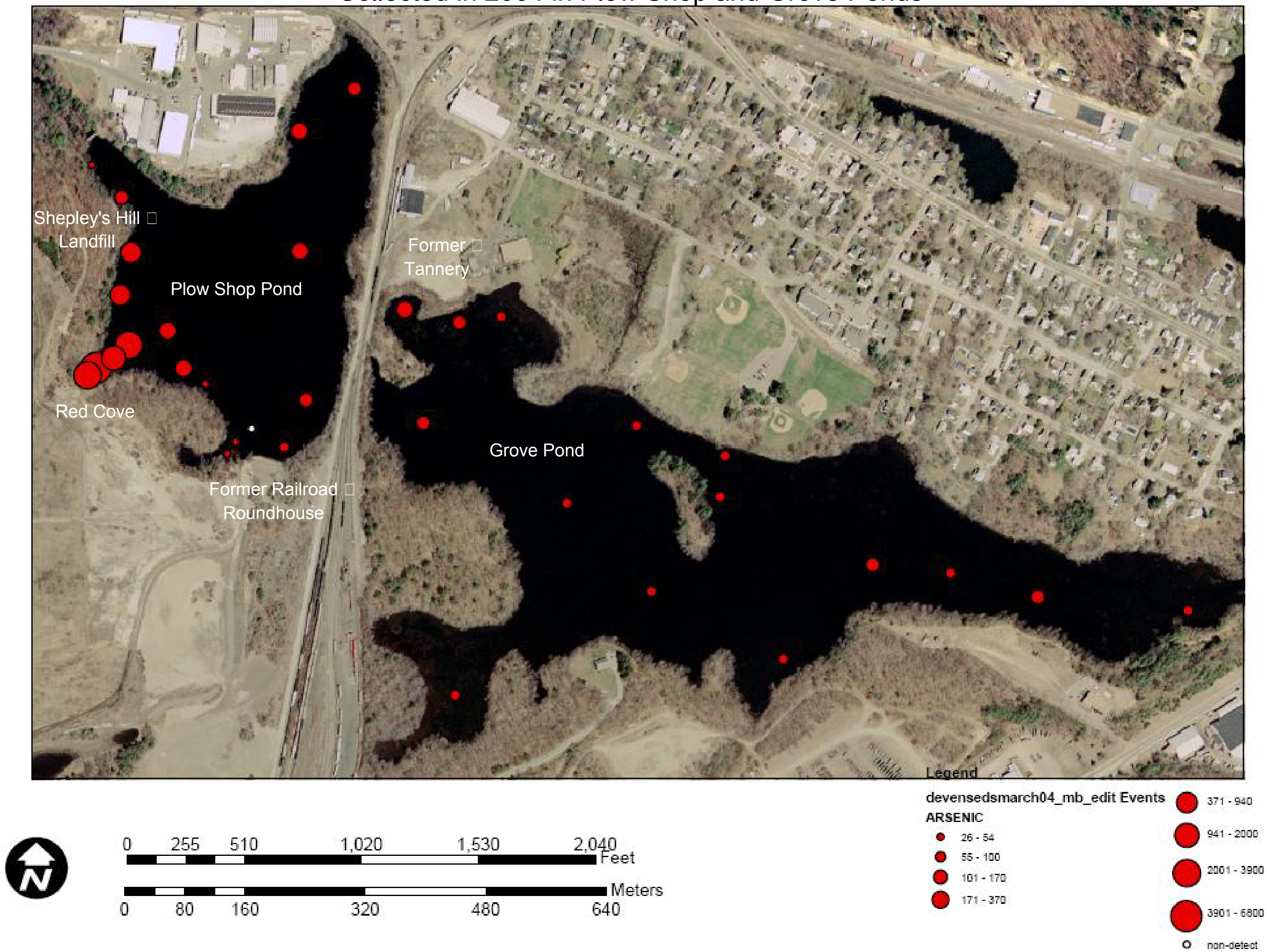
N

Figure 1. Spatial Distribution of Bulk Sediment Toxicity
Plow Shop Pond - Fort Devens, MA

This map produced by the EPA New England GIS Center
Additional Source: Dynamap Surface Water Features 1:24K
L:\projects\sites\devens\map documents\Sample_map2.mxd
24-June-2005

EPA United States Environmental Protection Agency New England

Figure 2. Relative Arsenic Concentrations Measured in Sediment Samples
Collected in 2004 in Plow Shop and Grove Ponds



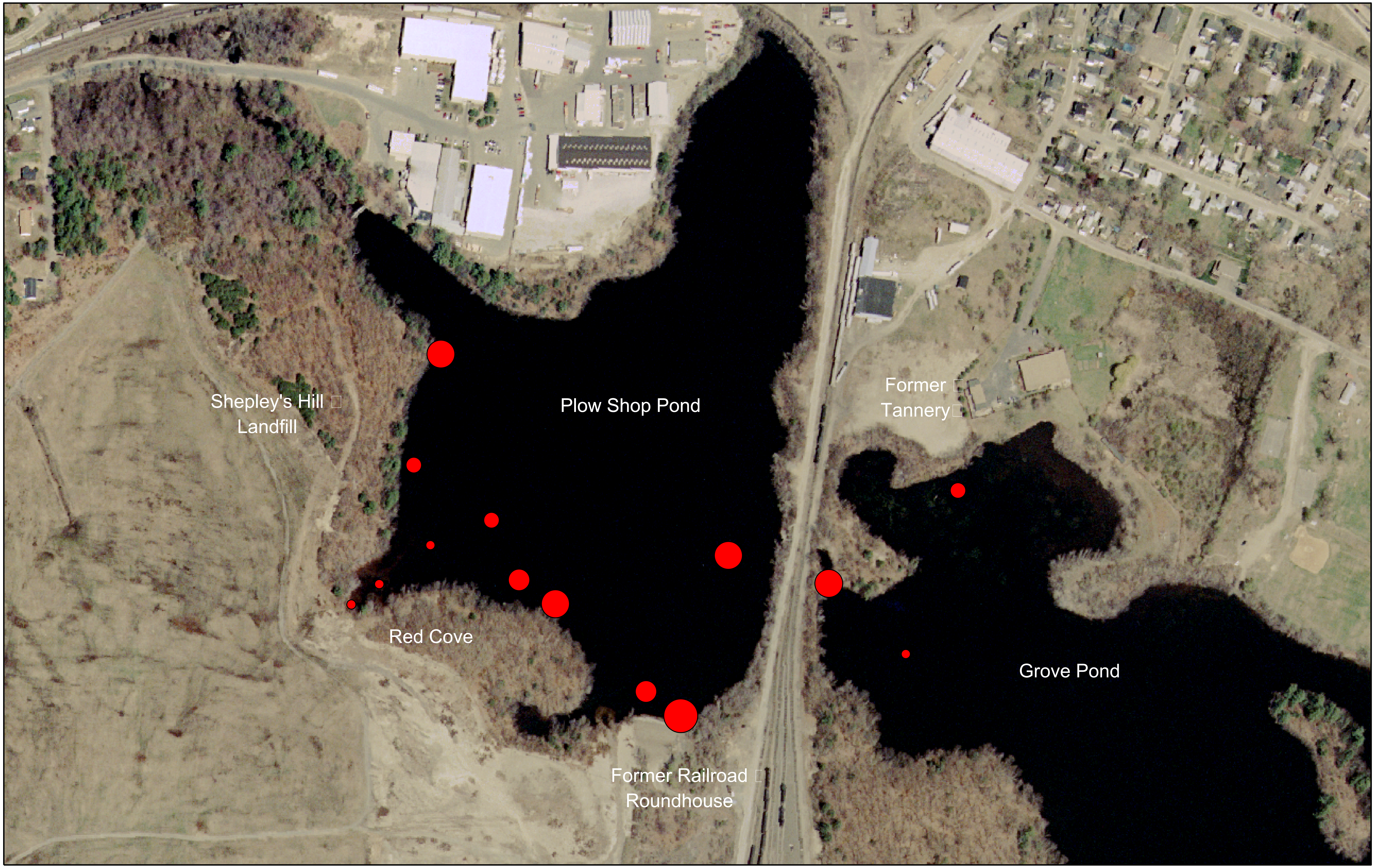


Figure 3. Relative PAH Concentrations Measured in Sediment Samples Collected in 2005

Fort Devens Superfund Site Ayer, MA

0 150 300 600 900 1,200 Feet

Meters 0 50 100 200 300 400

PAH Concentration (ug/kg)

- 1723.3 - 3829.0
- 3829.1 - 9162.0
- 9162.1 - 16163.0
- 16163.1 - 20438.0
- 20438.1 - 98650.0

N

EPA United States Environmental Protection Agency New England

Created by: EPA Region 1 GIS Center
Data Source(s): MassGIS Color Digital Orthophoto;
PAH Concentration Data Capture by ESAT
Location: L:\Projects\Sites\devens\map documents\devens_PAH.mxd
Date: 13-July-2005

Figure 4. Relative Chromium Concentrations in Plow Shop and Grove Ponds